OCTOBER, 1926

Railway Engineering and Maintenance

ROADMASTERS' CONVENTION NUMBER

RAILWAY ENGINEERING AND MAINTENANCE
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LIGHT enough for two men to handle, yet large enough to accommodate six, the new Mudge Class "A-1" is ideally adapted for use by roads on which the maintenance program provides for small gangs. The sturdy motor provides ample power for all ordinary conditions and it idles perfectly. The New Mudge thermo-syphonic principle water hopper permits three times the ordinary cruising radius.

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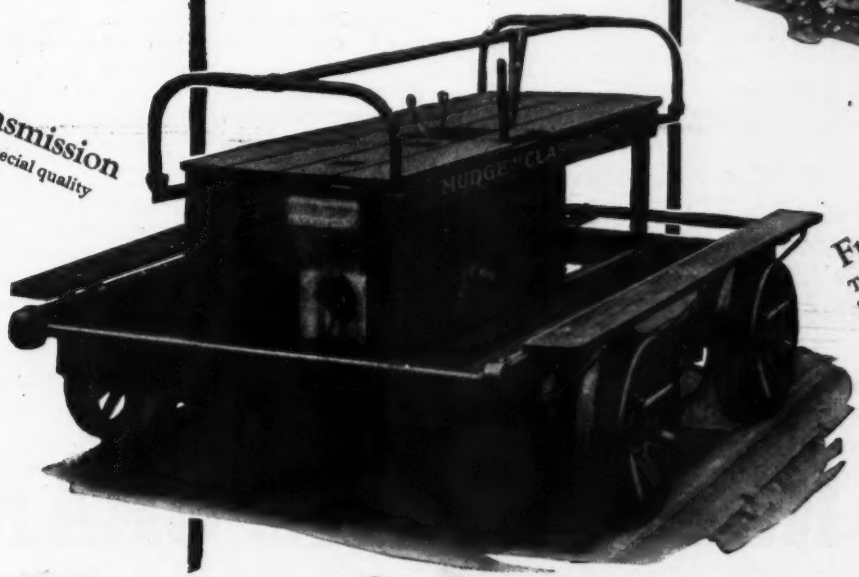

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THE PARSONS COMPANY
Newton, Iowa

PARSONS RAIL CRANE

FASTER RAIL LAYING—AT LOWER COST

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Railway Engineering and Maintenance

Formerly the Railway Maintenance Engineer

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Combination Lining Bar

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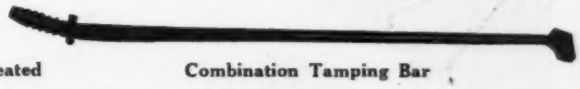

Combination Tamping Bar

REASONS WHY YOU SHOULD USE HACKMANN COMBINATION TRACK LINERS

They will line track, frogs, switches, raise low joints and space ties.

Can be operated against the end of switch ties when lining turnouts and puzzle switches.

You can make at least two pulls without resetting the base.

Three to five men can now do the work formerly done by seven to nine men and seven men can do the work of fifteen to twenty men.

They will pay for themselves in a very short time in the saving of labor and tools.

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Hackmann Combination Track Liner
Weight 20 lbs.

The lining and tamping bars are heat treated and the base is made of steel. Base weighs only 20 lbs.

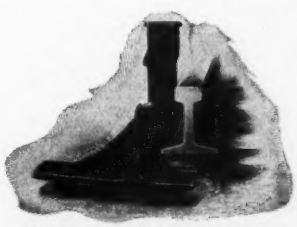
Our track liners are made of only two parts. Nothing to get out of order; very little digging necessary to set liners.

The use of these tools eliminate the constant use of other tools in connection with its performance.

Track lined with our liners remain in place longer than when lined with ordinary lining bars, as you do not disturb the roadbed.

More satisfactory results can be obtained with the Hackmann Track Liner than any other liner on the market.

WE ARE STUDYING YOUR PROBLEMS AND WILL GLADLY DEMONSTRATE
OUR METHOD OF LINING TRACK ON REQUEST



Hackmann Idol Track Liner

Hackmann Duplex Track Liner

FOR USE WITH ANY ORDINARY LINING BAR

THE HACKMANN RAILWAY SUPPLY CO.

RAILWAY LABOR SAVING DEVICES—723 So. Wells St., CHICAGO, ILL.

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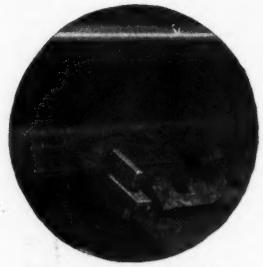
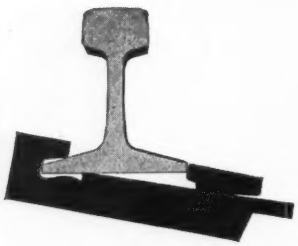
The "Bethco" Rail Anchor

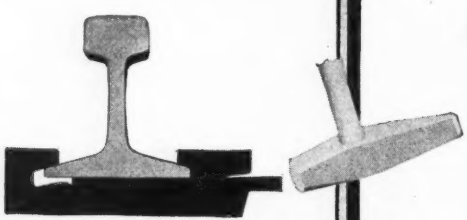


"Bethco" Rail Anchor installed

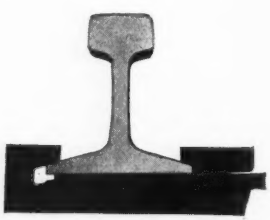
Easy to Install



Hook small end of yoke on rail base



Raise anchor lever with rail base



Drive key home—do not over drive

Disassembled and end view of the "Bethco" Rail Anchor. Sectional view of the key shows how the wedging action occurs.

The "Bethco" Rail Anchor, as shipped, is assembled and ready to install.

A Few Salient Features

Shipped, distributed and applied as one piece—parts do not separate.

No special tools are required.

Full length bearing against tie.

Fits new, rerolled old, worn or corroded rails.

Possesses all the advantages of one-piece anchor with the addition of positive take-up which only two pieces can provide.

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OVER GRADING
IMPROPER SEASONING
INFERIOR TREATMENT
DECAY
250 TIE RENEWALS PER YEAR

Another Achievement by the Pioneers

TWENTY years ago we advocated to railway engineers High Pressure Spring Washers. About 90% were opposed—10% in favor.

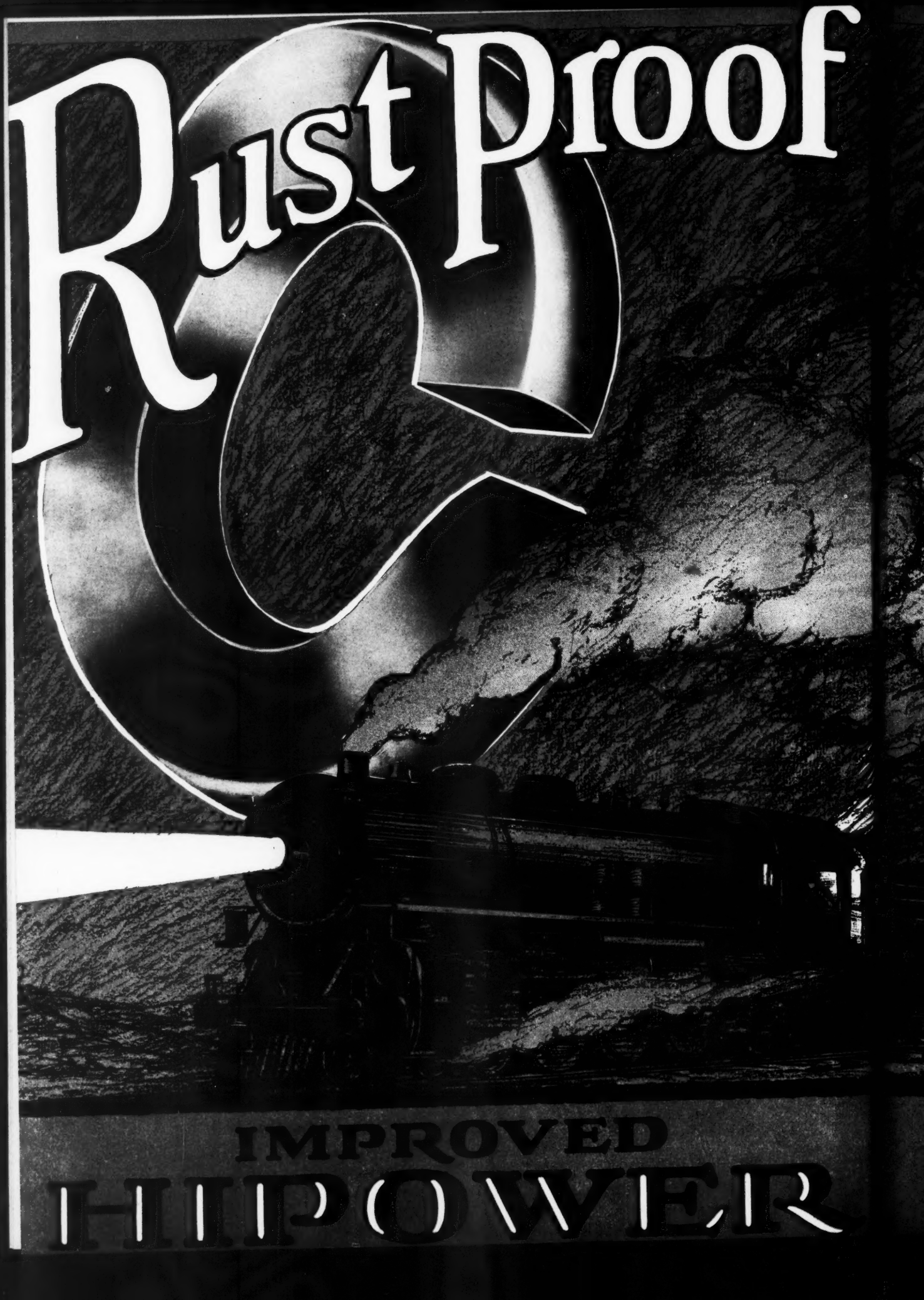
Ten years ago we placed HIPOWER on the market. About 85% were opposed to it—15% in favor.

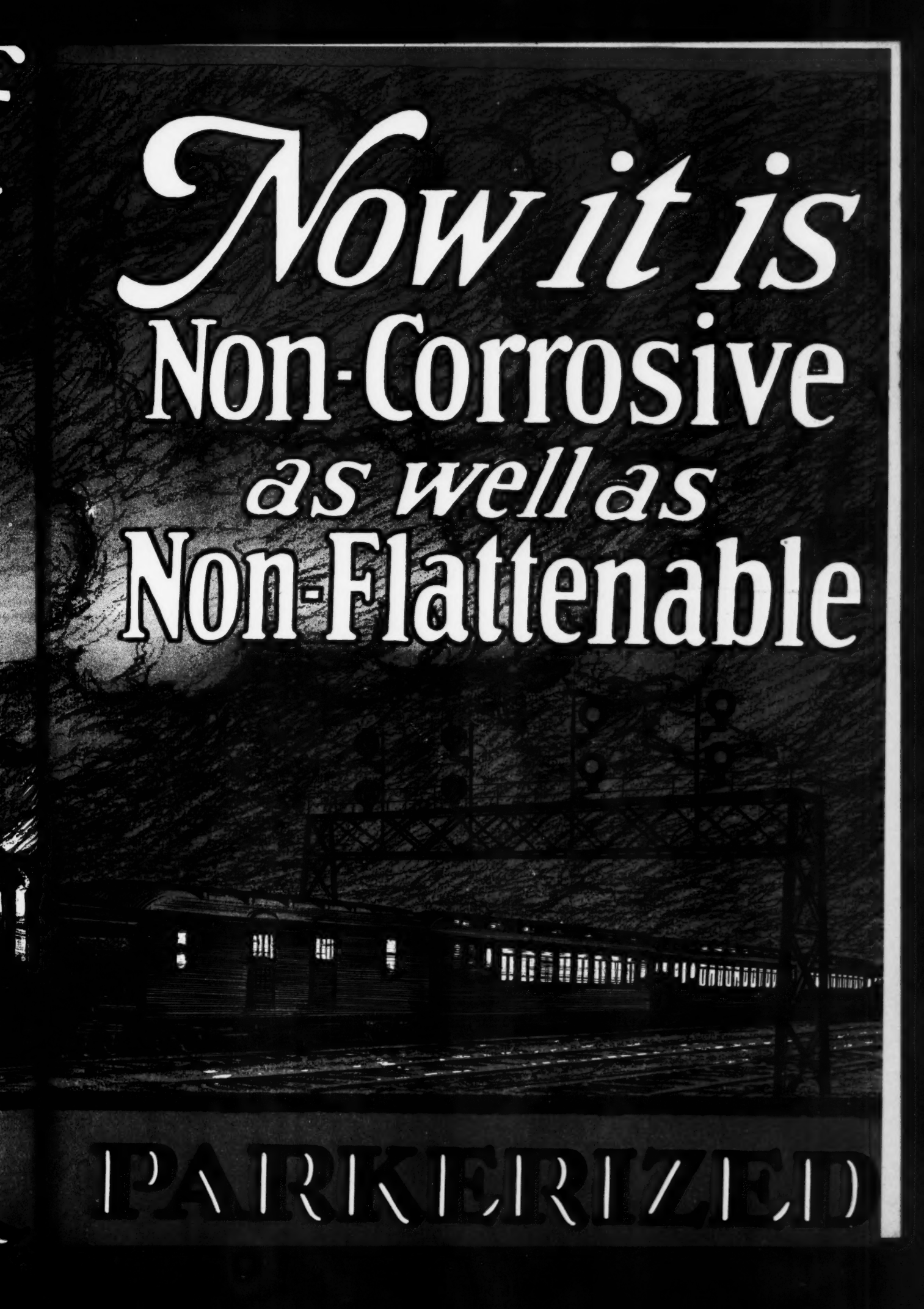
Today practically every railway system is using IMPROVED HIPOWER —and *every* railway engineer appreciates the necessity of High Pressures in Spring Washers.

Our theory is the same to-day as it was twenty years ago, because right is permanent. Our product has been vastly improved — IMPROVED HIPOWER *Parkerized.*

Rust-Proofing Spring Washers

IMPROVED HIPOWER PARKERIZED


Rust Proof
IMPROVED
HIPOWER


Now it is
Non-Corrosive
as well as
Non-Flattenable
PARKERIZED

Parkerized

WE are taking the occasion of the Roadmasters' Convention to announce the latest development of IMPROVED HIPOWER

Commencing October 1, 1926, IMPROVED HIPOWER will be *Parkerized.*

For many years we have been investigating various methods of rustproofing Spring Washers. Some methods are not injurious to the physical properties of the steel—neither are they permanent. Others are permanent but injurious to the spring temper.

Parkerizing is uninjurious and permanent. *Parkerizing* is not a plate, but a chemical conversion of the surface of the Spring Washer. *Parkerizing* permanently resists corrosion due to moisture, brine drippings and corrosive gases.

See Exhibit Space No. 55
Roadmasters' and Maintenance of Way Association Convention

The National Lock Washer Co.,
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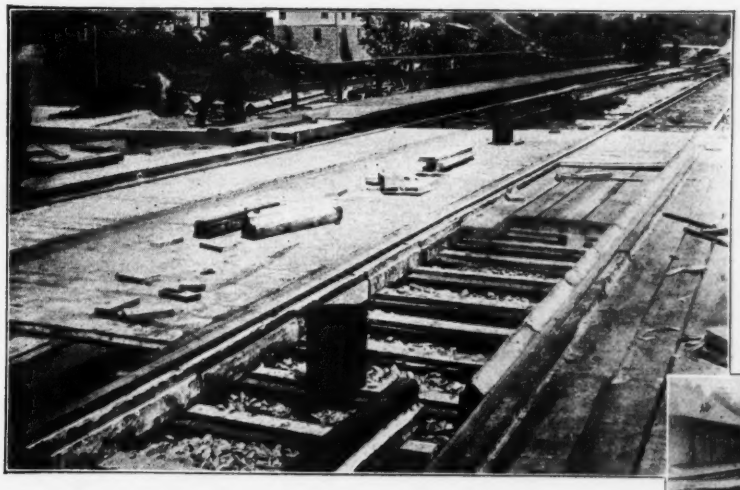
Protects them from Corrosion

IMPROVED
HIPOWER
PARKERIZED

Hit it Hard, Mr. Truck Driver



Heavy trucks cannot shatter this grade crossing, for it is being paved with Carey Elastite Preformed Track Pavement—Note details of construction!

With ordinary tools, the preformed slabs are easily installed under any weather conditions.

...*this* grade crossing can stand it

BUMPETY — Bang — Crash — goes the ten-ton truck as it hits the grade crossing with the force of a giant pile-driver!

But *this* grade crossing doesn't mind the abuse. It's paved with Carey Elastite Preformed Track Pavement—and experience has shown that it actually improves under the impact of heavy traffic.

Carey Elastite Preformed Track Pavement consists of pavement slabs about 2 inches thick and sections of rail filler, both made from a fibrous asphaltic material that knits together and heals under traffic. It fits snugly — excludes water and frost — keeps the crossing water-tight at all times. And the hammering of heavy trucks cannot shatter it — in fact, hard wear keeps it in condition.

The preformed slabs are cut to fit, and are easily installed with ordinary tools — under all temperature or weather conditions. Write — today — for the complete story of this new, improved grade crossing pavement.

THE PHILIP CAREY COMPANY, *Lockland,* Cincinnati, Ohio

Carey Elastite

PREFORMED TRACK PAVEMENT

"Knits and heals under traffic"

You'll find your

The Kalamazoo No. 16-L Motor Car seating one to three men

Before the Time of Kalamazoo Products

NO. 1 OF A SERIES

In the days before Kalamazoo hand cars were known, men **walked** to work. They trudged miles down a dusty track, carrying their heavy tools and materials on their backs. By the time they reached the job they were too tired to do a day's work. At night they carried their big loads back home. Hours of valuable time were wasted every day.

The Kalamazoo Hand Car and later the Kalamazoo Motor Car brought a radical change. Men no longer had to carry tools and materials on their backs and could ride to and from work.

Today Kalamazoo Hand Cars are still used to some extent, though superseded largely by Kalamazoo Motor Cars, which are the favorites of railroaders who appreciate a quality and a service that have grown up with the railroad industry.

"Kalamazoo Means Service to You"

Men speeding to and from work on a fast Kalamazoo Motor Car are SURE to get there and back ON TIME.

KALA-
LI

What It

The name **Kalamazoo** on any car is a guarantee of quality. Our factory has developed the most modern line of railway motor cars, embodying the latest improvements in automotive engineering — the ideas of Safety, Comfort and Power being followed in all models. Each car is designed to service, **and nothing but service.**

KALAMAZOO RAILW

KALAMAZOO,

Atlantic Coast R. R. Makes New Ones Out of Old Ones at Florence, S. C.

New Platforms for Old!

"Kyrock" takes the grief out of construction and maintenance on grade crossings, runways, trucking areas, freight and passenger platforms, bridge floors, shop floors, etc. Investigate "Kyrock."

Kyrock does it *quickly, cheaply*

Shovel it on, rake to grade, roll it and the job's done. Lay it *cold* on any base, *worn* brick, block or macadam. Investigate "Kyrock."

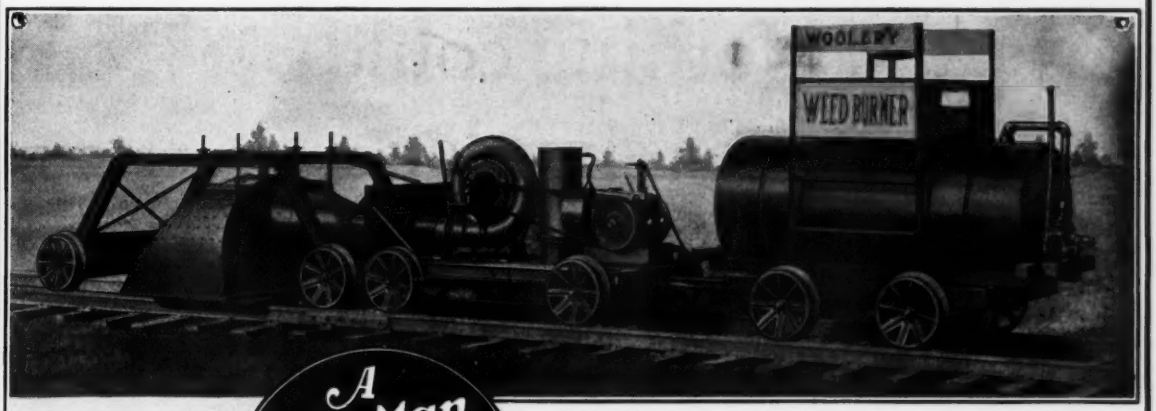
KENTUCKY ROCK ASPHALT CO. INC. LOUISVILLE, KY.

Kyrock

The Perfect Pavement

KENTUCKY ROCK Kyrock ASPHALT

WAR on WEEDS



A Two-Man Outfit of Guaranteed Efficiency Average cost on first heavy burning less than $3.00 per mile

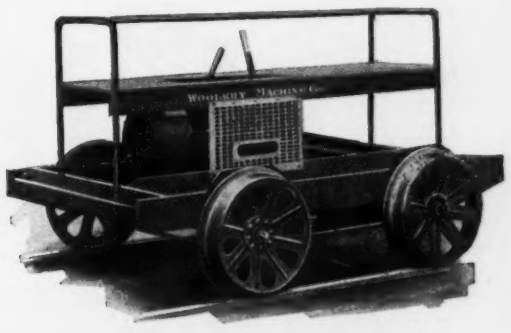
Enlist the help of the Woolery Weed Burner—the "Little Corporal" of track equipment—to clean those tracks before the peak of the season's hauling is upon you.

Napoleon, with his highly trained armies, did no more deadly work than does this modern machine when headed into the serried ranks of Quack Grass, Russian Thistle, Johnson Grass and all the host of other pestiferous weeds that reduce the tractive power of your giant locomotives.

When the Woolery goes in, the Weeds go out!

If you want to fight obnoxious vegetation on your lines with the quickest, cheapest, most effective method known—use the Woolery.

Railway Motor Cars
Gasoline Engines
Rail Layer Attachments
Tie Scoring Machines



See our exhibit at the Roadmasters Convention—Space 49

Woolery Machine Co., Minneapolis, Minn.

Railway
Engineering and Maintenance

Volume 22 October, 1926 Number 10

THE MAINTENANCE OF TERMINAL TRACKS

THE problems involved in the maintenance of tracks vary widely. The task of the branch line foreman and supervisor differs radically from that of the men on high-speed heavy-traffic main lines. Likewise, the work on sections out in the open varies from that in congested terminals. Nowhere are the problems more acute than in the terminal at St. Louis, Mo., where, as pointed out by H. J. Pfeifer, chief engineer of the Terminal Railroad Association of St. Louis, in a paper read before the Roadmasters' Association and abstracted on a following page, the locomotives of 18 different railroads operate in and out of that terminal daily.

In maintaining tracks with curvature of 16 to 20 deg. and with many single and slip switches and crossings, Mr. Pfeifer has made certain observations which afford valuable guides for other men maintaining less complicated track layouts. He has found, for instance, that with a limitation of speed to 20 miles per hour, tracks can be maintained in better condition without superelevation and without increasing the gage for curvature. It has also been found that many derailments occur at guard rails, with the result that self-guarded frogs have been substituted. These and other observations of Mr. Pfeifer's make his paper particularly valable for the man confronted with the necessity of maintaining tracks in terminals.

WHOSE DUTY IS IT?

"WHO should insist on good ties? The track man, first, last and all the time." In this positive manner, John Foley, forester of the Pennsylvania, placed the responsibility for the receipt of ties of proper quality in his address before the Roadmasters' Association. In this statement Mr. Foley did not mean to imply that it was the function of the track man to negotiate for the ties that he required or that he should inspect those purchased prior to acceptance, for a special organization has been created and trained for these duties. Rather, he had in mind the thought that it was the duty of the track man to make his wants known through the proper channels to the purchasing department in such specific terms that it would know what was required. In the absence of such advice, a purchasing officer has little incentive to purchase other than the cheapest, and necessarily inferior, ties, for if the department using the ties is not sufficiently interested in them to specify the quality desired, the purchasing officer cannot be expected to take on himself the responsibility for imposing more severe restrictions.

The principal reason for the acceptance by the railways of many inferior ties in the past has been the indifference of maintenance officers to the quality of the ties furnished them. When they awaken to the necessity of themselves specifying the quality of the ties that they desire and of then checking the ties delivered to them with sufficient care to assure themselves that their requirements are met, the purchasing department will provide those ties. There is no inherent conflict between the two departments, for they are both employed by and are serving the same railroad and are concerned with the purchase of those ties that will render the most economical service. In attempting to awaken track men to their responsibility for the securing of ties of this character, Mr. Foley is rendering a service to the railways of no small magnitude.

GIVE IT A FAIR TRIAL

IN discussing the problem of introducing the water-cement ratio in the proportioning of concrete for the purpose of securing better and more uniform results, the masonry engineer of a certain railroad reported that he had experienced little difficulty in interesting contractors in the improved practices and in getting them to apply them in work which they were doing. On the other hand, he had encountered indifference, if not open opposition to his suggestions on the part of those in charge of the railroad's regular concrete forces.

Concrete construction, unlike other building work, can hardly be classed as a skilled trade in which knowledge is imparted by master to apprentice. Instead it entails the application along practical lines of scientific principles developed through laboratory investigation. Current knowledge of concrete is yet admittedly incomplete; practice is still subject to change as the knowledge is amplified by continued study. Nevertheless, the attitude of the concrete foreman is that he has been thoroughly trained in his trade and that there is nothing further for him to learn, particularly when what he is asked to learn appears to be much more involved than the method which he has been following.

The basic principle of the water-cement ratio is simple. Briefly, it amounts to this: The strength of concrete varies only with the proportion of the water to the cement in the mix. The only limitation placed on this rule is that the proportion of cement to sand and stone must be such as to produce a *workable* mix and that the aggregates are clean and sound. So long as the proportion of water to cement is fixed, variations in the proportions of sand and stone and in the grading of the particles influence only the *economy* of the mix. In other words, given a certain strength as determined by a fixed ratio of water to cement, a study of the proportions and the grading of the particles will

make it possible to use more stone and sand with a fixed amount of cement and still obtain a workable mix and therefore secure the same strength as could have been obtained with a less amount of sand and stone if the proportions and grading had not been so carefully determined.

Of course, this idea is a marked departure from the practice of using arbitrary proportions such as 1:2:4, 1:3:6, etc. Furthermore, some of the earlier applications of this principle were carried out in an exceedingly involved fashion entailing a lot of complex mathematics and the use of charts, etc. However, this is not necessary unless it is desired to secure a high degree of refinement in developing the most *economical* mix.

It is also well to bear in mind that many operations which seem exceedingly complicated when attention is first directed to them prove relatively simple after they have been repeated a considerable number of times in actual practice. However, it is necessary to put them into actual practice in order to understand them thoroughly. Pinochle, bridge whist, or in fact, almost any worthwhile card game, seems hopelessly involved to the novice. Indeed, it is doubtful if any of them could be understood simply from an explanation. It is necessary actually to play them in order to get the idea. So it is with the application of the more scientific methods of making concrete. They must be "played with" in order to appreciate their full significance and those who have put them into use say that once the methods are thoroughly understood, their application becomes a matter of mere routine. If construction contractors, who are surely the most practical of all men in modern business, have found these methods workable surely they can be applied by railway men in charge of work done with company forces.

THE MAINTENANCE DEPARTMENT'S SHARE

ALTHOUGH the railways have made a remarkable record in the reduction of accidents among their employees in recent years, the Safety Section of the American Railway Association has set before them a goal of a still further reduction of 35 per cent in the number of accidents by 1930. That such an objective is commendable and entitled to the wholehearted support of every railway employee goes without saying. That it is attainable is equally capable of proof if every employee will do his full share to bring it about.

As pointed out by Mr. Carrow in his address before the Roadmasters' Association, which is abstracted on a following page, 31 per cent of the deaths and 22 per cent of the injuries to railway employees occurred among the men in the maintenance of way department. If the railways as a whole are to achieve the goal set for them, it is evident, therefore, that the maintenance of way department must make a corresponding reduction in its accidents. Will it do this? The members of the Roadmasters' Association can do much to insure an affirmative answer.

The members of this association and their associates in the bridge and building department are in immediate charge of maintenance of way work and the responsibility rests on them for the formulation of the methods for its prosecution. It is their duty not only to note and correct the dangerous practices among their forces and dangerous conditions in the property under their supervision, but to train their men in safe as well as efficient methods. Constant vigilance and alertness to observe dangerous practices are essential, for once a dangerous condition is detected the remedy is usually obvious. The problem of accident prevention is one of accident education. It includes training in safe methods of work. Even more, it includes the implanting in the minds of the workmen the idea of the folly of taking a chance.

In his address Mr. Carrow has pointed out an opportunity for the Roadmasters' Association to render a constructive service to the railways and particularly to the employees in their own department by undertaking a detailed investigation of the causes of the accidents among track forces and of ways for eliminating them. It is to be hoped that as a result of Mr. Carrow's address, the Roadmasters' Association will appoint a committee to study this subject and to co-operate with the Safety Section of the American Railway Association in the attainment of its objective.

IT IS NOT ONLY POSSIBLE BUT ENTIRELY PRACTICABLE

NOT all of the advance in bridge and building methods has been confined to steel, concrete and the newer materials of construction. Marked improvements have also been made in the use of wood which are not so apparent because the changes have taken place more gradually. Nevertheless, many of the methods that were followed in the use of wood during the days when the railroads were new have gradually been superseded by practices which make for greater economy and longer life of the wooden structures.

Nearly everyone has at some time had an opportunity to examine an old barn with a massive frame of hewed timbers in which the tennons, by means of which the load on the stringers was transmitted to a girder, were formed by cutting down the stringers to no more than half of the full cross section, while the girder suffered an equal loss of strength by large and closely spaced mortises. This practice was justifiable in the old days because timber was cheap and the use of sticks of excessive size readily compensated for the loss of strength in framing. The same custom was formerly applied in railroad bridge construction, and it will be recalled how the posts in frame bents and even the piles in trestles were tennoned to fit between the two pieces forming a double cap. But with increased knowledge of structural design and of the behavior of notched and mortised timbers in service, the fallacy of reducing the strength by excessive cutting came to be appreciated. Moreover, it was also recognized that various forms of hardware offered means of fastening sticks together in a thoroughly effective manner and at far less expense for labor than was required in the careful shaping of pieces to form joints.

The advent of timber preservation gave a new impetus to this change in practice in the framing of timbers. As creosoted timbers came into general use, it was soon found that the framing or sizing of timbers was in large measure defeating the purpose of impregnating them with preservative materials. In too many cases it was found that the anticipated life of a sound and thoroughly treated stick of timber had been appreciably shortened by ruthless cutting that extended well into or entirely through the protective shell of impregnated wood.

That a certain amount of framing, or more properly —"sizing," is necessary, was an accepted fact; that this work had to be done by carpenters on the ground, according to long established customs of measuring and fitting that form a fixed part of the carpenter's trade was also deemed as something that must also be accepted. But advocates of timber conservation were

not satisfied and finally a few of them decided to do what practical men said was not practical, to do all of the cutting, and even the boring of bolt holes before the timber was treated. It is true that this involved some difficulties. It required careful and painstaking measurements. It entailed more elaborate bills of material, sketches or diagrams of the pieces ordered and a comprehensive system of identifying marks. In general, it implied the application to timber structures of the system which had long been accepted as necessary for the fabrication and erection of steel bridges. However, notwithstanding these necessary refinements, the plan proved an entire success.

As yet this practice is not as generally applied as it should be. In most cases it has been adopted as an added refinement by railroads already committed to the use of treated timber in their structures, but as described elsewhere in this issue one road recently undertook the pre-framing of timbers as an essential feature in the initial application of treated materials to its trestle decks. A study of the article in question should show that there is nothing particularly intricate or impractical about the methods followed.

THE VALUE OF A STABILIZED FORCE

STATEMENTS of the value of stabilized forces in keeping experienced men in the service has come to be regarded so often as legendary instead of thought-compelling truths that concrete examples of this value are always of interest to the men who are responsible for the maintenance of our railroads. An article in the September issue of *Railway Engineering and Maintenance* on the organization and methods of rail laying gangs inaugurated by the Chicago, Milwaukee & St. Paul with the present year describes the manner in which it attacked this problem. As stated in that article, all main line rail on that system is laid by four large rail gangs, each in charge of a roadmaster, which work according to a program laid out by the engineer maintenance of way and the general roadmaster, one gang being assigned to each general superintendent's territory.

The results of this policy have been gratifying and it has demonstrated a marked reduction in labor turnover and a betterment in the morale, as compared with a corresponding number of men in small gangs, while the efficiency of the gangs, due to their specializing in one branch of work, has shown a marked increase as the season has advanced. Illustrative of this feature is a recent day's work by one of these gangs composed of 115 men, 15 of whom were assigned to the work train picking up the released material. This gang, on September 9, laid 414 39-ft. rails of 100-lb. section, or 16,146 lin. ft. of rail, replacing 90-lb. rail, which required the pulling of all four rows of spikes to remove the 90-lb. tie plates and to apply the new 100-lb. plates. No advance work had been done prior to the morning of that day and all of the work was completed that evening, including the loading of the released rail.

Aside from the benefits cited there have been collateral advantages of value which have accrued from this method, not the least of which has been the securing of standardized practice with a minimum of supervision. Much of the objection to the use of extra gangs has been based on the fact that many times their work has been done with the idea of quantity rather than quality as the goal. With the type of supervision provided for on the St. Paul this objection loses its weight and the results of the plan have demonstrated its value.

Letters to the Editor

CAN IT BE MADE A SUCCESS?

Carbondale, Ill.

To the Editor:

The question of sand blasting bridges preparatory to painting has been discussed for some years; yet there seems to be some doubt even in the minds of those closely associated with the care of steel structures as to whether the practice is economical or may be considered good practice.

It is only in terminals or interlocking plants that compressed air is available and even the use of a small portable air compressor involves the expenditure of considerable labor for unloading and entails either the service of a work train or a serious delay to a local freight. Furthermore, extra scaffolding and the drying and screening of sand add to the expense.

The surface of a steel plate that has been sand blasted until it appears bright, has a rough texture like a cat's tongue and is susceptible to corrosion unless it is coated with paint immediately. But this cannot be done until the sand blasting is finished, for the dust will adhere to the fresh paint. While sand blasting will remove old paint and light rust, it will not remove "black rust" or heavy scale. This must be removed by sharp blows with a scaling hammer. Again, why remove the old paint film? It does no harm and the new coat of paint will carry sufficient linseed oil or other "binder" to make it adhere, for paint on steel surfaces, if properly applied in the first place, will rarely peel.

The painting of steel bridges in the field by the spray process has been done with more or less success from time to time by various railroads, but usually they have returned to ordinary brush methods. One reason for this is the greater consumption of paint (usually about 20 per cent more than that required for brush application). Thus, quoting from the September issue, page 356: "On large bridge work it has also been found impracticable to use the paint spraying equipment since it is very difficult for the operator of the gun to work effectively, unless he has a firm footing and both hands free to manipulate the gun and support the paint hose. * * * Another instance of the difficulty encountered in bridge painting with the paint gun has been the inside faces of deep, adjacent plate girders particularly on some of the New Haven's larger exposed river bridges, where strong air currents carry the paint spray away from the surface, while in any outside painting, it has been found difficult to use the paint spray economically in a strong wind. This is particularly true when the air currents are at right angle to the flow of the paint from the gun."

Men using the sand blast must wear an almost air tight hood and goggles, or glass set into the cloth hood to protect themselves, and men using the paint spray, especially in the floor systems of bridges where the air becomes "rich" with the paint fumes, must wear a special mask which filters out the particles of paint from the air they breathe. This makes the process very objectionable from the workmen's standpoint.

When the various experiences and difficulties are summed up and considering that both sand blasting and paint spraying of bridges have been tried for a number of years and have not come into general use, it is reasonable to say they have not proved practical.

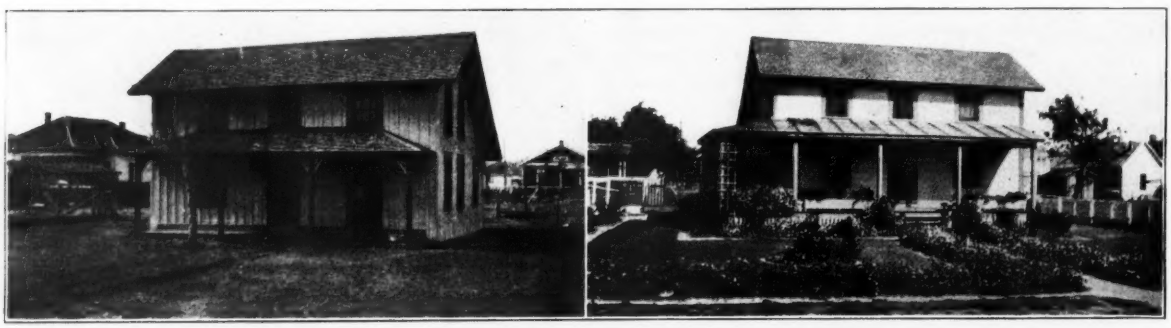
H. J. BARKLEY,
Assistant Supervisor Bridges and Buildings, Illinois Central.

How Cotton Belt Cut Malaria Rate 97 Per Cent in Nine Years

Sanitary Engineering Staff Carried Remedial Measures to Men in Field Also Stimulated Improvement in Station and Camp Car Sanitation

By H. W. VAN HOVENBERG
Sanitary Engineer, St. Louis Southwestern, Texarkana, Texas

A REDUCTION in the number of employes admitted to the hospital for malaria from 100 per thousand in 1917 to 3 in 1925 is the outstanding achievement of the sanitary engineering department of the St. Louis Southwestern in the nine years since its organization. This, however, comprises only a portion of its work for it has inaugurated a campaign for more efficient sanitation of stations which has raised the average rating of all stations from 54.0 to 84.7 with practically no expenditure by enlisting the interest and co-operation of the agents. By similar measures, the condition of the section houses has been raised from an average of 50.9 to 79.2 while over 1,500 ft. of concrete walks were built around these buildings last year without cost to the company.



The Section House at Corsicana, Texas, Before and After Improvement

The improvement of the appearance of the station grounds, the inspection and certification of drinking water supplies, the supervision of the cleaning of passenger equipment, and a wide variety of laboratory analysis work are other activities of the sanitary engineer.

The Railroad and Malaria

The St. Louis Southwestern operates 1,748 miles of lines southwest from St. Louis through Missouri, Arkansas, Louisiana and Texas with 160 agency stations serving towns ranging from a few hundred population to cities such as St. Louis, Memphis, Little Rock, Pine Bluff, Shreveport, Waco, Ft. Worth, and Dallas. With the wealth of natural resources found in this territory, and the further advantage of long growing seasons and plentiful rainfall, these cities and towns are growing rapidy. Practically 70 per cent of the road's tonnage in 1925 was products of agriculture, mines and forests and 53 per cent of the total tonnage originated on its lines.

In contrast with this wealth, the long growing season and plentiful rainfall are responsible for an enormous problem for the sanitary engineer, brought about chiefly by the abundant opportunities for mosquito breeding. This is true of both cities and rural districts. The resulting malaria is a decided handicap to both industrial and agricultural development wherever steps have not been taken toward mosquito control. The larger cities and towns are fairly well advanced in sanitation, but the smaller towns and rural districts have yet to solve their problems of water supplies, sewage disposal, milk and mosquito control, and other health protective measures.

Sanitary Engineering Department Established

As early as 1916 the St. Louis Southwestern employed between 6,000 and 7,000 men, a large proportion of whom were recruited from the adjoining rural districts where the malaria rate was high. This was particularly true of track department employes which are usually recruited from rural districts. Many others, such as bridge and building men necessarily worked in the river bottoms, while the two large system shops were located in cities having high malaria sickness rates.

In the fall of 1916 Edwin Gould, chairman of the board of directors, visited the company hospital at Texarkana, Ark., and found from the hospital records that one-third of the medical cases treated in the hospital were for malaria. This high malaria rate was not peculiar to the Cotton Belt alone as studies of other railroad hospitals in contiguous territory show almost identical rates. The seriousness of malaria among employes can be better appreciated when we add to this hospital rate three or four times as many malaria sufferers who were treated either by local surgeons, or who treated themselves. Such a sickness rate during the season of increased railroad activities could not help but be reflected in reduced man-power earnings. After consulting government and other malaria specialists, Mr. Gould established a trust fund to be used for the eradication of malaria on the Cottton Belt and on July 1, 1917, the position of sanitary engineer was created among the general officers of the road. The present sanitary engineering department on the Cotton Belt, which has in its personnel, besides the writer, an assistant sanitary engineer, a chemist, an entomologist, a malaria tech-

nician, sanitary inspectors, and a gardener is an outgrowth of this pioneer work in railroad malaria control engineering.

Malaria is by far the biggest health problem of the South. It has been rated by the late Dr. H. R. Carter, past assistant surgeon general, U. S. Public Health Service, as far more serious than typhoid, dysentery, pellagra, and tuberculosis combined. Malaria is a mosquito-borne disease and is carried from man to man by the female of the species known as the anopheles. When taking her blood meal, this female mosquito sucks the malaria parasites from the blood of a person suffering with malaria and in due time she injects the fertilized parasite into the blood of a well person where the parasite feeds and multiplies at the expense of the red blood cells, breaking down the cells and sapping the vitality of its victim, and, in the acute stages, producing the so-called "chills and fever."

The Railroad's Program

The Cotton Belt's malaria program was planned to give relief to both employes and dependents and to further joint mosquito eradication campaigns in cities and towns served by the railroad. Briefly, the methods employed were: (1) The eradication of mosquitoes by drainage and oiling. (2) The proper screening of living quarters to prevent access of infected mosquitoes to well persons. (3) Quinine prophylaxis. (4) Education.

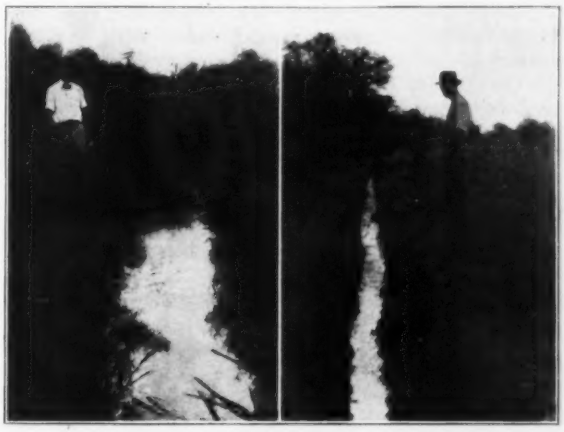
When malaria control work was inaugurated on the Cotton Belt, the aid of the U. S. Public Health Service was enlisted and surveys made of various shop and division points where large numbers of employes and dependents lived, and of a number of important industrial cities and towns suffering the

Spraying Oil Over Stagnant Water

same loss as the railroad in inefficient labor, decreased man-power, and the resulting lowering output. Co-operation in the form of sharing in expense and in giving engineering direction to the work was offered by the railroad to these cities and towns and the work of draining, oiling, and filling commenced. As an indication of the quick results that can be obtained from malaria eradication, the following letter from E. L. Kurth, secretary-treasurer of the San Augustine Lumber Company, Keltys, Texas, is quoted:

"For your information, we wish to advise that this community has been practically free from malaria since this work has been completed. Our roll of sick employes has been less than ever before, and consequently, with fewer men to draw from, we have been able to ship almost 20 per cent more lumber this year than ever before, due to the fact that the men we had were able to work regularly and were not out on account of sickness. . . ."

These towns scattered over the St. Louis Southwestern Railway System have now assumed the entire cost of malaria control work, but where necessary the railroad continues to offer expert advice in effecting more economical control methods



A Typical Ditch Before and After Cleaning

and assists them by furnishing a mixture of crude and headlight oil from the oil tank car it maintains.

Specifications for screening have been adopted by the railroad and all replacements are made in accordance with these specifications. The specifications provide for 16 mesh wire, full length screens constructed of 1¼-in. seasoned material and hinged so that they may be easily opened or removed. The screening of stations, section houses, office and other company buildings is covered by these specifications. Bunk and other outfit cars are provided with 16-mesh wire and vestibules enclosed with canvas to prevent access of mosquitoes.

Since the major part of the malaria work in the various cities and towns is now a regular part of their civic programs, our energies during the past few years have been concentrated on the protection of maintenance of way employes. During 1925 a total of 74,441 quinine capsules were distributed at 30-day intervals over a total of 945 miles. Records indicate that 87.8 per cent of this quinine was taken. The effectiveness of quinine as a prophylaxis is reflected by the decrease in the hospital malaria admission rate from 215 per 1,000 section men in 1913-1916 (prior to malaria control) to less than 2 per 1,000 section men in 1925. The following table compares the hospital malaria admissions for the years 1921, 1922, 1923, 1924, and 1925 with the four years (1913-1916) prior to malaria control work:

Class of Employes	Average 1913-1916	1921	1922	1923	1924	1925
Section men	258	80	24	16	13	3
Extra gang men	134	12	43	21	13	8
Bridge and building men	89	30	10	11	2	4
Shopmen	73	10	6	10	3	3
Trainmen	27	9	2	6	1	0
Station men	13	5	8	0	1	1
Yardmen	4	2	0	0	1	1
Division office men	1	0	1	4	2	0
Miscellaneous men	3	5	4	2	7	2
Total	602	153	98	70	43	22

It has been our practice during the past five years to search out employes suspected of suffering with

malaria, who are urged to go to the company hospital for treatment and rest. When discharged from the hospital these men are given enough quinine to complete the 60-day quinine treatment. The inspectors in the sanitary engineering department keep in close touch with these men and urge them to complete their quinine treatment, and from time to time take blood specimens for examination in the malaria laboratory. This laboratory service is an essential part of our program. With each successive year more employes come voluntarily for blood examination for malaria.

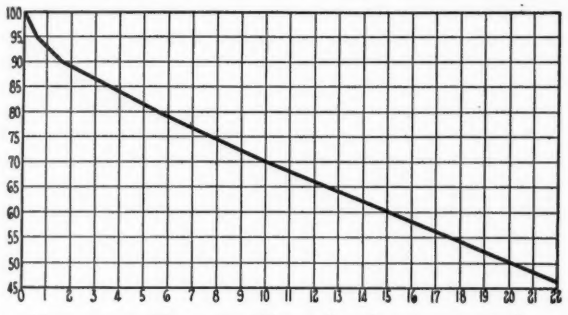
Early in our campaign we realized that education of the people must go hand in hand with any successful pioneering in sanitary engineering activities. There are still far too many people who believe and maintain that malaria is obtained from sleeping in the night air, or by eating too much watermelon, or by drinking water with scum on it. This is not to be wondered at if we consider that it is only a few years since General Gorgas made his courageous fight to convince our own government officers of the necessity of conquering the mosquito if we were to build the Panama canal.

In order to tell the story of the cause and prevention of malaria in the railroad's educational campaign, an elaborate exhibit car was equipped and put on the road in 1919. This car housed models showing the characteristics of different mosquitoes, of good and poor farm drainage, of proper and improper methods of building stock ponds, of the right and wrong methods of screening houses, and of various other features in connection with mosquito control. This car visited every city and town on the lines in the malaria territory and the exhibit was either set

Interior of the Exhibit Car Anopheles

up in the public schools or the school children invited to visit the car itself. This educational program was supplemented by a state-wide malaria essay contest for cash prizes donated by Mr. Gould.

The net result of the railroad's malaria program since its inception in 1917 has been the lowering of the general hospital admission rate for malaria from 100 per thousand men employed to less than 3 per thousand men; together with the stimulation of mosquito eradication work in St. Louis Southwestern cities and towns having an estimated combined population of over 600,000. In Texas the population under mosquito control includes 95 per cent of the Cotton Belt's employes. Not only has this pioneering work on the Cotton Belt resulted in so much good to its own employes and increased operating efficiency and industrial stimulation, but it has been the means of furthering this character of work in many other cities and on other railroads. There is still abundant opportunity for other Southern railroads to invest little and repay bountiful returns, both in furthering



Percentage Chart for Measuring Improvements in Station Sanitation

a kindlier and more productive spirit among their employes and in furthering a very desirable relationship with the patrons they serve.

Station Sanitation Has Also Been Undertaken

In the fall of 1919, the management of the St. Louis Southwestern decided to pay more attention to the cleanliness of its stations. Various methods in use on a number of railways were studied. In each instance the cost was thought to be prohibitive since the lowest estimate was upward of $80,000 per year to provide any regular system of cleaning.

As the railroad was at this time employing several sanitary inspectors during the malaria season of the year, the suggestion was made that these men be employed throughout the year, under the direction of the sanitary engineer, in developing a clean station campaign, this campaign to be based on creating a desire on the part of the station agents for clean stations, rather than the adopting of a program by the company which would call for the expenditure of considerable money.

This "Clean Station Campaign" was launched in January, 1920. The program was:

(1) To have clean stations every day of the month by securing and maintaining the friendly rivalry of agents in competing for awards of merit, based on the cleanliness of their stations.

(2) To prevent station fires through proper care of flues and stove piping; through proper storage of inflammables; by ridding the station premises of rubbish, litter and trash, and the accumulation of years of obsolete station junk.

(3) To prevent accidents by the removal of and the forbidding of the placing of materials about station grounds that might obscure the approach of trains.

(4) To secure for the railroad the good will of the traveling patrons of the road by having clean waiting room and toilets for their accommodation; in other words, the favorable advertising of the road by its patrons.

(5) To protect company freight, particularly perishable commodities, from rats.

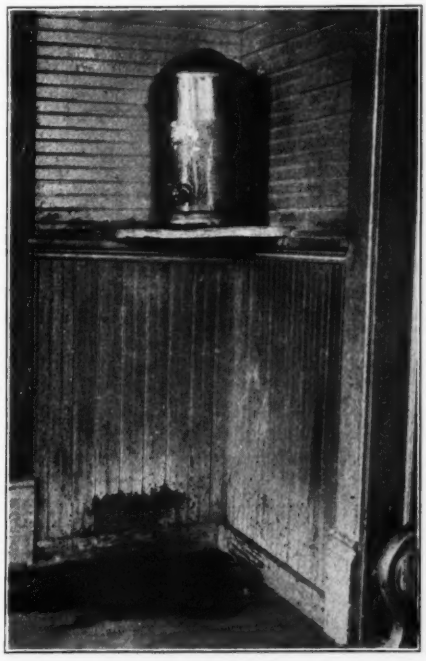
(6) To promote station efficiency by teaching agents and their forces the value of keeping station material in its place.

(7) To create a spirit of loyalty to the company's interest on the part of the agents, by their

making minor repairs to station property, and by their preventing patrons from abusing the physical property about the station and grounds.

Those familiar with railroads will recognize at once the countless ways in which station property may be destroyed, as for example by a small leak in a station water cooler which will eventually rot out the station flooring and sills, necessitating the calling of a bridge and building gang to repair the damage. Roof leaders are continually being broken at the ground, permitting the rush of water during rains to destroy gravel or chat platforms, and dislodge bricks in permanent platforms. The arms of a station seat may become loosened and finally broken, and protruding screws possibly tear the clothing of patrons. Water from the station coolers and sinks frequently discharges under the station, keeping the sills moist and aiding in their destruction. This condition is also favorable for the breeding of mosquitoes. The careless handling of live coals not only injures the floors to the point where they must be replaced, but may be responsible for the loss of a station by fire. The promiscuous tacking of placards on both wooden and plaster walls is destructive. Screen doors and windows are continually in need of minor repairs.

There is probably greater abuse to railway station toilets than any other part of the station equipment. In most instances the station toilets are public conveniences and it is usually the townspeople and not



A Leaking Water Cooler Will Soon Destroy Floor

the railroad patrons who misuse these facilities and who resent it when the agent keeps the toilets locked except prior to the arrival of trains. It is not unusual to find lanterns,electric lamps, plumbing fixtures, and padlocks stolen, and even privy doors torn from their hinges. For the railroad there is practically no relief from such depredations. It may be that the Southern states will some day follow the lead of certain others in requiring incorporated cities to maintain public comfort stations. It is not improbable in the meantime to think that we may have railways and cities cooperating in the building of comfort stations maintained by municipal appropriations. Certainly cities have much to gain in knowing that their patrons have access to clean toilet facilities.

The basic principle of the "Clean Station Campaign" is enlisting the good will of the agents to maintain their station and premises in good or fair shape throughout the entire year with their own forces and with no increased cost to the company. To systematize the work and equalize the chances of both the large and small stations obtaining comparable station sanitary scores, a score card was devised to record the sanitary rating of the various units of the station, both interior and exterior. On this score card the different units such as waiting rooms, office, express room, freight room, and the toilets are assigned "weights" according to their value from a sanitary standpoint.

Inspection service is divided into three periods of four months each for the year, and usually two inspections are made during each period. In making this inspection the inspector makes a note of all items needing correction from a physical and also a sanitary standpoint. The defects are discussed with the agent and he is urged to correct them. In the event that he does not, or cannot, final correction is handled by the operating department.

To stimulate the interest of the agents when the campaign was first launched, trophy cups were donated by four directors of the road and offered as division prizes. As interest in the campaign grew, additional prizes were offered until today the trophy cups have been replaced by vacations with pay and substantial cash awards for system records.

It is interesting to note that prizes are not awarded in our "Clean Station Campaign" for the highest scoring station, but for the greatest per cent of improvement made in successive competition periods. By means of a scoring chart every station is put on an equal basis and the measure of any agent's work is found by comparing his actual increase with what is set for him to do according to the graph. If he makes his prescribed increase he is given a judging per cent of 100. Any station may attain a judging per cent of over 100 by making more than the required points and conversely.

On the first inspection of stations the average sanitary score of all stations was 54.0. By the end of 1920 the average score had increased to 70.3 and today it is 84.7. Our records show that in 1920 the lowest scoring station on the system had a sanitary score of 11.0, while for the first period of 1926 the lowest score assessed against any station on the system was 68.3. The following statement shows the results that have been obtained in the "Clean Station Campaign" during the past five years:

Summary of System Average Station Sanitary Scores

	First Score 1920	Final Score 1920	Final Score 1921	Final Score 1922	Final Score 1923	Final Score 1924	Final Score *1925	First Score 1926
Average	54.0	70.3	81.2	82.3	82.6	83.8	82.8	84.7

*A new and more rigid inspection score card was put in use in 1925 which accounts for the apparent decrease that year.

The operating officers have given their hearty support to the work and have expressed the opinion that the sanitary rating of the station is almost a perfect index to an agent's qualifications. Various letters of commendation from the traveling public have been received and the agent himself has not only enjoyed the satisfaction of clean surroundings, but has enjoyed the friendly rivalry.

Early in the malaria control work we used extra gangs which were moved from town to town in

Station _____ Competition No. _____

Final Score _____ Inspection No. _____

Inspector _____ Agent _____ Date _____ Hour _____

ST. LOUIS SOUTHWESTERN RAILWAY LINES

OFFICE OF SANITARY ENGINEER

RAILWAY STATION SANITARY SCORE CARD

	UNIT			UNIT			UNIT			UNIT		
	Dusty Dirty	Stained	Total	Dusty Dirty	Stained	Total	Dusty Dirty	Stained	Total	Dusty Dirty	Stained	Total
Floor	14	12										
Walls	10	8										
Wainscoting	10	8										
Ceiling	6	4										
Doors	10	6										
Transoms	6	4										
Windows	11	9										
Screens	11	9										
Odor	10											
Untidy	20											
Other												
Total Housing												
Furniture	11	5										
Cuspidors	6	5										
Refuse Cans	9	4										
Seats (wait. rm).	12	5										
Water Cooler	8	3										
Store	5	5										
Coal Bin	3	2										
Lights	6	4										
Signs and Posters	6	4										
Parcel Lockers	4	2										
Telegraph Apparatus	2	1										
Mail & Phone Box	2	1										
Shelves, Counters	8	4										
Partitions	6	2										
Platform Scales	2	1										
Closets	6	2										
Fire Apparatus	2	1										
Other												
Total Fix. & Furn.												

Remarks:

Unit No.	Outside Station Layout—Etc.	Max. Demerits	Demerits	Score
	Station (outside) Dirty	20		
	Steps Dirty	15		
	Bulletin Boards Dirty	8		
	Mail Box	2		
	Lights	10		
	Semaphore	2		
	Freight Platform	10		
	Trucks	4		
	Station Platform Untidy	20		
	Privy Path Obstructed	5		
	No Night Soil Box	10		
	No Flap on Privy	5		
	No Lock on Privy or W. C.	15		
	Odor of Privy or W. C.	5		
	Water Bbls. need Lime	15		
	Total			

Note Special Conditions and Explain Below
Bad Drainage—Under Station—Platform—Drives
Roof Gutters—Broken—Clogged
Platform—Rough—Weedy—Needs Repairs
Station—Outbuildings—Need Paint—Repairs
Park Needs Attention
Toilet Fixtures—Leaking—Out of Order
Hydrants—Water Coolers—Leaking
Signs—Posters to be Removed—Station—Premises
Company Material Piled on Premises
Safety or Fire Hazard Needs Attention
Hotel Runners—Service Cars Encroaching
Other
Other

Stations' Sanitary Score Card

STATION :	NAME:	DATE:	INSPECTOR:
SCORE :	PHYSICAL (100)		
LEFT: RIGHT:	Company's Responsibility:		REMARKS:
: :	A. Dwellings & Structures 20.		
: :	I Repairs:		
: :	1 Siding		
: :	1 Chimney		
: :	1 Porch & Steps		
: :	1 Foundation		
: :	1 Roof		
: :	1 Privy		
: :	1 Yard Fences		
: :	1 Door		
: :	3 Door Screens		
: :	1 Windows		
: :	3 Window Screens		
: :	2 General Repairs		
: :	II Paint:		
: :	1 Dwelling		
: :	1 Yard Fence		
: :	1 Privy		
: :	TOTAL COMPANY'S RESPONSIBILITY		
	Foreman's Responsibility 80		
: :	B. Dwellings & Structures		
: :	I Repairs:		
: :	2 Doors		
: :	4 Windows		
: :	6 Window Screens		
: :	8 Door Screens		
: :	4 Water Supply		
: :	7 Temporary Fence		
: :	8 Garage, Wood Shed, Chicken House		
: :	3 Gates		
: :	6 Walks		
: :	4 Drives		
: :	2 Gutters & eaves		
: :	4 Yard Fences		
: :	II Paint		
: :	10 Temporary Fences		
: :	10 Garage, Wood Shed, Chicken House		
: :	TOTAL FOREMAN'S RESPONSIBILITY		
	BEAUTIFICATION 100		
: :	C. Walks & Drives		
: :	5 Not Defined		
: :	5 Size & Arrangement		
: :	D. Lawns		
: :	10 Surface		
: :	10 Drainage		
: :	10 Sodding		
: :	10 Uncut Grass and Weeds		
: :	E. Planting		
: :	10 Trees		
: :	10 Shrubbery		
: :	5 Vines & Trellises		
: :	5 Flowers		
: :	F. Tidiness		
: :	30 General Tidiness		
: :	TOTAL BEAUTIFICATIONS		
: :	G. ADDITIONAL MERITS OR DEMERITS		
: :	GRAND TOTAL SCORE		

Chart for Scoring Section Houses

drainage and oiling work. During this period we had ample opportunity to learn from experience what it cost to feed our own labor properly in contrast to the high prices and unsatisfactory living conditions on many of the other extra gangs. The continued complaints of extra gang laborers led the company, on March 1, 1921, to contract for boarding service with one of the large boarding contractors. Then in turn the extra gang foremen took occasion to complain of this service, and bitterly so because they lost such lucrative incomes from boarding and other deductions. The continued turmoil led to this department beginning the inspection of eating and sleeping conditions on all of our extra gangs. Inspection score cards similar to the illustration were adopted which relegated to the company and to the boarding contractor their respective responsibilities toward the extra gangs as a whole, the company being responsible for the physical condition and upkeep of the cars and the boarding contractor responsible for the sanitary condition shown on the score card. In the fall of 1922 we recommended that the dining car department of the St. Louis Southwestern take over the boarding of extra gang labor, since the company had accumulated practically all of the culinary and sleeping equipment necessary to equip all of the extra gangs during the shopmen's strike that same year. This change was made in the spring of 1923. Since then there has been a general increase in both the physical and sanitary condition of our outfit cars since the original scoring. The net result of our own company running the extra gangs is that the dining car department is showing a net return each year

Department _____ No. _____ Extra Gang _____
Foreman _____ Located at _____
Commissary Clerk _____ Cook _____
Waiter _____ Inspected by _____
Date _____ 192_ No. of men in camp _____

- CONDITIONS FOR WHICH COMPANY COMMISSARY IS RESPONSIBLE -

EQUIPMENT:	PER FECT:	ALL-OWED:
(a) Cond. of premises(5)___(Absence of com.& kitchen refuse)	5	
(b) Cleanliness of floors(5) tabs.(5) benches(3) walls(1) ceil.(2) wind.(1)	17	
(c) Storage facilities for food supplies (10) (Refrigerators, flour and meal bins, food protected from weevils and rats in store car)	10	
(d)Condition of condiment containers (3)	3	
(e)Cond. of implements & utensils for cook.(5) serving(5)	10	
(f)Lavoratory facilities (5)	5	
(g)Dish washing facilities (5) (Hot water boiler)	5	
QUALITY OF FOOD:		
(h)Quality of food supplies (10)	10	
HANDLING AND PROTECTION:		
(i)Personal Cleanliness of employes (5)	5	
(j)Handling of food supplies (Preparation (10) (serving(5)	15	
(k)Absence of flies (10) insects and rodents (5) (due to doors NOT standing open: if flies present due to defective screens, so note in this space)	15	100

- CONDITIONS FOR WHICH RAILWAY COMPANY IS RESPONSIBLE -

EQUIPMENT:		
(a)Condition of floors(5) tables (5) benches(3) walls(5) ceiling(2)	20	
(b)Light(5) ventilation(5)	10	
(c)Cond.of screens over doors & windows & spgs.on doors (15)	15	
(d)Water tight roofs (10)	10	
(e)Lavatory facilities (10)	10	
PHYSICAL CONDITION OF WATER SUPPLY:		
(f)Approved source (10)	10	
(g)Condition of tubs (cleaned as required(5) portection against contam.(5)	10	
(h)Method of handling water from tanks (10)	10	
PREMISES:		
(i)Condition of premises (3) (Waste Paper, clothing and other refuse around bunk cars and right of way)	5	100

REMARKS:

Sheet for Noting Conditions in Camp Car Food Inspection

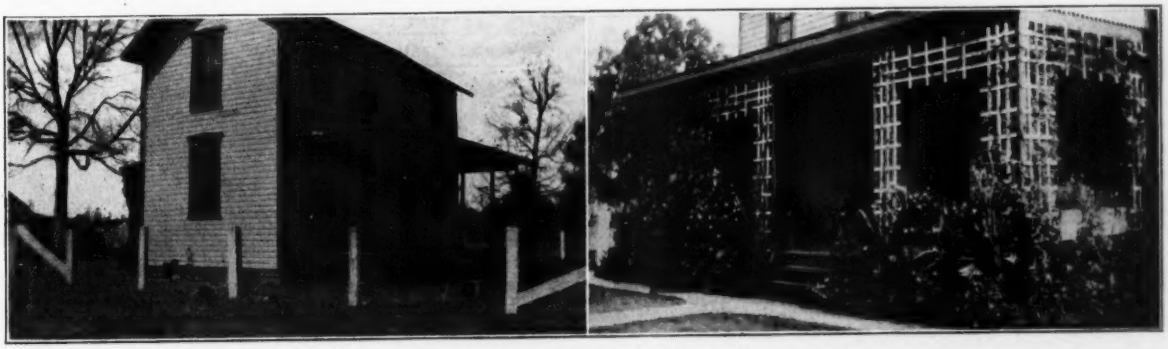
and the boarding car situation is entirely satisfactory. We plan to put into operation several recreation cars during this season as a means of securing a better quality of labor on our gangs. We have no regular inspection periods, but each division inspector makes this score as often as he passes boarding cars in connection with his other regular duties.

Section House Improvement Campaign

The improvement of section house premises on the St. Louis Southwestern began in the spring of 1921 with a three-fold purpose in view; first, and most important, being the conservation of company property; second, that of stimulating home building and securing greater contentment among track department employes as an aid in reducing turn-over, and third, as a beginning of a general plan of beautification of all company property including station grounds and right of way in and about cities, shops and terminals, all as a valuable medium of advertising to the traveling public. The beginning of this improvement campaign embraced a stretch of 186 miles over which there was a decided lack of interest on the part of section house occupants, and on which there was a continual changing about of foremen. The plan of the campaign was to first get the premises in a neat and tidy condition. This included taking down dilapidated fences and out-buildings, removing trash and litter, moving wood piles to inconspicuous places, building clothes lines, all in accordance with a standard plan. This preliminary clean-up was followed by terracing, leveling, and sodding of heretofore grassless yards, it being our policy to stress well-kept lawns as the first essential in beautification. Next came the planting of trees and shrubbery, and the building of trellises, sidewalks and driveways. Practically all of this improvement work was done by the foremen on their own time and at their own expense.

An Attractive Section House and Bunk House at Perkins, Mo.

This experiment in 1921 proved so satisfactory that we were authorized to extend the program over the entire system with the result that the average improvement score of our section house premises today is 79.2 compared with the original first score of 50.9. Some of our section homes have won prizes in their communities in the state and city "Better Homes Contests." The result of the improvement campaign, aside from the pronounced interest in maintaining real homes that anybody could be proud of, has been a decided lowering in the turn-over of section foremen, and an almost unbelievable decrease in the destruction of company property as compared with the days when our section houses were little more than shelters and certainly when they bore no resemblance to real homes. An example of the willingness of the foremen to participate in this contest is their building over 1500 ft. of concrete sidewalk in 1925 with their own funds. The company on its part has provided many of the section premises with different varieties of fruit trees, has made a renewed effort to keep the premises in a good state of repair, and has provided electric lights, city water, sleeping porches and bathrooms for quite a number of the section

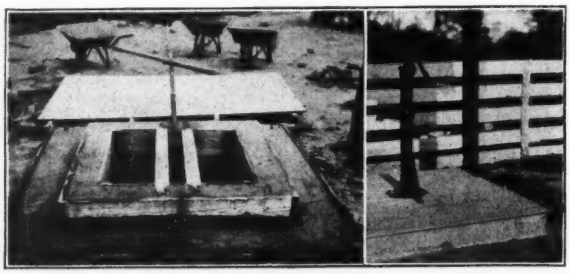


The Section House at Louisville, Ark., Before and After Improvement

homes. Cash prizes and vacation leaves are given foremen and their families winning highest places in this contest, and the roadmaster making the greatest per cent improvement on the Arkansas and Missouri and on the Texas lines is sent to the convention of of the Roadmasters' and Maintenance of Way Association.

Station Park Improvement Is Marked

One outgrowth of the section house improvement campaign has been that of parking and landscaping about the more important passenger stations and terminals over the system. As might be expected the many years of abuses of station premises in many towns resulted in very unsightly station surroundings



Protecting a Well From Surface Water

and in almost every case in encroachments on the property itself. The station improvement work was fostered in a large part by cooperation offered the railroad by civic associations, and, from a small beginning made in 1922 twenty-two station properties have been improved by building driveways, concrete or improved walks, and the planting of shrubs and trees grown in the company nursery at Pine Bluff, Arkansas.

In the planning of new stations, or the rebuilding of old, the sanitary engineer's office cooperates with the operating and engineering departments in the details of the construction and improvement of grounds, especially with reference to sanitary features, drainage, and future pedestrian and vehicular traffic. We find the expense involved in the improvement of station grounds is not onerous and that there is an ever-increasing demand on the part of the large and small towns for this improvement.

The Laboratory Renders Valuable Aid

In 1922 the first survey of the St. Louis Southwestern's locomotive boiler water situation was made by a chemist employed in the sanitary engineer's office. In 1924 the railroad adopted a policy of boiler water treatment, wherever required, and the first four lime-soda plants were constructed in 1925. The 1926 budget provides for the treatment of a number of other boiler water supplies so that by 1927 the bad boiler water condition will be entirely eliminated.

The outgrowth of the first simple water laboratory has been the gradual building and equipping of a physical, chemical, and bacteriological laboratory at Mt. Pleasant, Texas. As an indication of the service it renders, 327 analyses of paint, oil, grease, water, milk, coal, oxygen, sand and clay were made in 1925. The laboratory has been of special service owing to the fact that the St. Louis Southwestern is an oil-burning road over a major portion of its lines, necessitating frequent fuel oil analyses.

A sanitary and bacteriological survey of the drinking water supplies serving all section houses on the Texas lines was made in January, 1924. Of the 67 supplies, only 25. 4 per cent could be classed as safe, including even those served from municipal supplies. The contributing factors to this condition were: (1) the almost universal use of windlass and bucket for drawing water; (2) lack of protection of the wells from infiltration of surface drainage at the ground level; and (3) either underground cisterns that allowed infiltration of ground water, or cisterns filled with water from an undesirable source. The following table summarizes the types of water supplies and shows the per cent found unsafe:

GROUP	Total Number	Total Number Safe	Total Number Unsafe	Per Cent Safe
City water used	16	8	8	50.0
Bored well, cased	8	3	5	37.5
Dug well, tile walls	3	0	3	0.0
Dug well, cement and brick walls	3	0	3	0.0
Dug well, walls of loose bricks	3	1	2	33.3
Dug well, earth walls	11	1	10	9.0
Underground cistern, tight walls	8	3	5	37.5
Underground cistern, leaky walls	11	0	11	0.0
Overground cistern	4	1	3	25.0
Totals	67	17	50	25.4

An interesting observation made along with the survey of section house water supplies is the relation of the number of public water supplies to population. We found in East Texas where the ground water is close to the surface and always abundant, that there are large communities without a public supply, while in West Texas, where the cost of obtaining water at a considerable depth is high, we found communities of three or four hundred population having a common water supply.

The bacteriological tests of the section house water supplies were made in accordance with the Ameriacn Public Health Association standards. Following the survey, standard plans were prepared and A. F. E.'s submitted for reconditioning all section house water supplies. Several well supplies were abandoned and city water secured. After the rebuilding of the wells and cisterns these supplies were chlorinated and retested bacteriologically after a time interval, so that today we are reasonably sure of safe supplies for our

Community	Number Having No Public Water Supply	Number Having A Public Water Supply
Under 250	37	1
250-500	15	4
500-750	5	2
750-1000	1	4
Over 1000	1	29
TOTAL	59	40

Table Showing Water Supplies in Reference to Population

section forces. Coincident with this improvement work, we recommended to and cooperated with the Employes' Hospital Department in the giving of typhoid serum to over 1800 employes and dependents in the track department in the summer of 1924. The reconditioning of section house supplies on the Arkansas and Missouri lines is now under way.

The sanitary engineering department handles the certification to the U. S. Treasury department of water used by passengers and employes for drinking and culinary purposes. Arrangements are also made through the dining car department for the chlorination of all water used by extra gangs as soon as the water cars are returned to the gangs from being filled at an approved source.

Five years ago members of the sanitary engineering department began a series of meetings on each

roadmaster's district with section foremen and officers of the track department. Subjects of mutual interest in health and sanitary control were discussed and a contact established between employes and the operating officers in such questions as arose. These meetings have been expanded with annual meetings of the sanitary engineering and maintenance of way departments at which all division engineering officers and foremen meet with the operating officers of the road and with representatives from practically all other departments of the railroad. These meetings are now an institution on the railroad and with each successive year their worth to officers and employes becomes more apparent.

As a means of standardizing the cleaning of passenger equipment at cleaning terminals, a sanitary car-cleaning score card was devised in 1924 and inspections made by division inspectors at intervals sufficiently frequent to keep this work up to a fair standard. Except where required by law, deodorizing devices were removed from equipment and buildings in line with modern sanitary practice and emphasis placed on having cleaning done with soap and water in such a manner that it was not necessary to disguise poor cleaning work with deodorants.

The sanitary engineering department has cooperated with other departments on the railroad in handling insects in boarding cars, and with county officials in the control of an acute grasshopper invasion in 1925 over parts of the Texas lines. In this last work we developed a method of control which was quite effective by applying hot atomized oil on our right of way as a check control with the ordinary poison bran method.

Conclusions

As a result of our experience we might group railway sanitation into three classes, namely:

(1) The protection and comfort of traveling public.
(2) The protection and comfort of employes.
(3) The protection and conservation of company property.

A majority of the states have adopted the "Standard Railway Sanitary Code" as approved by the United States Public Health Service. Aside from the regulations governing the transportation of persons having communicable diseases, all other phases of this code, such as water and ice supplies, cleaning and disinfection of cars, cleaning of cars in service, and sanitation of stations and construction camps, are strictly sanitary matters and best handled by men trained in sanitary engineering, and they are so handled on the St. Louis Southwestern. Other items having to do with the safety and comfort of the traveling public include the proper heating and ventilation of trains and stations, the routine inspection and analysis of food supplies served on diners and in railroad eating houses, the proper lighting of stations and trains, the elimination of mosquito and fly pests around terminals, and proper sanitary provision for new station and office facilities.

The problem of the protection of railroad employes differs considerably from ordinary municipal applied sanitation because employes are scattered over so many miles and through so many different states. Safe drinking water for employes must include safe section house wells, safe municipal supplies where any considerable number of employes are grouped, and provision for safe water for the men grouped in extra gangs, bridge and building and other camps.

It is entirely reasonable that many municipalities in the Southwest have not advanced to the same high state of municipal sanitation as those in the older settled portions of the country where highly trained sanitary engineers have long been employed, so we may expect that it will take time, patience, and real cooperation between the railroads, municipalities, and state health departments before the day of safe drinking water everywhere comes. In the meantime, temporary expedients may be employed to provide safe water for employes and railroad support given cities and towns looking toward safe drinking water supplies. This again is within the province of the sanitary engineer, who becomes the railroad's representative in such matters.

The South has a tremendous problem to solve in the eradication of malaria. The railroads operating in this territory carry a tremendous burden occa-

CAR CLEANING SCORE

Car Number _____ Going Out on Train No. _____

Inspection Made At _____ By _____

Cleaned At _____ On _____ By _____
Foreman

	Item Value	Score Given
A. FLOORS (20)		
1. Isle Carpet	5	
2. Bare Floor	15	
B. WALLS (13)		
3. Heater Units	5	
4. Window Sills	3	
5. Walls	3	
6. Mouldings	2	
C. Ceilings (5)		
7. Mouldings	2	
8. Ventilators	3	
D. Seats (20)		
9. Headrests	5	
10. Chair arms	5	
11. Chair Cushions	5	
12. Chair Framework	5	
E. Toilets (17)		
13. Hoppers	7	
14. Wash Bowls	7	
Paper racks not full, other parts	3	
F. Vestibules (5)	5	
G. Equipment (13)		
15. Cuspidors	5	
16. Lamps	1	
17. Luggage Racks	2	
18. Drinking Founts	5	
H. Windows (7)		
19. Sash Window	3	
20. Storm Window	3	
21. Curtain	1	
Special Notes		
Grand Total Score	100	

Record Sheet for Checking Car Cleaning

sioned by this entirely preventable disease, not only in inefficient labor, but in decreased haul from industrial and agricultural activities. It is surprising that even the more efficiently managed railroads have not seized on the opportunity so easily at hand to increase efficiency, better living conditions of employes and stimulate industrial activity. We find practically all railroads with extensive agricultural and industrial departments looking toward increased production, but few at the present time concerned in the building up of man-power through which only the maximum increase can be effected.

Other activities of the sanitary engineer looking toward the comfort and protection of employes include the inspection of food and quarters furnished extra gangs, the proper heating and ventilation of offices where numbers of employes are working, the regulation of the cleaning of offices, and the encouraging of better living conditions.

It is certainly true that there is much more abuse of property used by the public than of privately owned property and this is accentuated on railroads where state laws and regulations require that a certain class of accommodations be provided without

regard for their proper policing. This disregard is not entirely chargeable to the traveling public, but rather to the townpeople who make free use of railroad station buildings and toilet conveniences. The only defense the railroad has against abuse of its stations lies in the care exercised by its agents.

In developing a sanitary engineering department on the St. Louis Southwestern it was expected that difficulty might be encountered in coordinating its activities with the various other departments of the railroad. Doing old things in a new way is not appreciated by some officers, and any innovation is likely to be met with by opposition, unless there is a desire on the part of the management for the success of such a movement. The sanitary engineering department on the St. Louis Southwestern has had the confidence and support of the management and its contact with other departments has been facilitated through the continued interest of the president and particularly the vice president in charge of operation, through whom routine matters are handled. In conclusion, it is fair to state that applied sanitation on the St. Louis Southwestern has passed the experimental stage. Beginning with the malaria program conceived by Mr. Gould in 1916, sanitary engineering has become a permanent railroad enterprise, and for no other reason than that such a policy is sound business for a progressive railway.

Erie Frames and Bores Bridge Ties Before Treatment

THE FRAMING of bridge ties or timbers before preservative treatment is a refinement of practice that has usually been adopted by a railroad some time after the use of treated timber has become thoroughly established. However, on the Erie, complete arrangements for the framing of timbers before treatment were perfected and put into use simultaneously with the adoption of treated timber as the standard material for the renewal of bridge decks.

The Erie uses creosoted red oak for its bridge ties and guard timbers or ribbon guards, the practice of using treated material having been adopted with no change in the construction details of the bridge deck other than to abandon the old dapped type of guard timber in favor of the plain 4-in. by 8-in. piece which is used without framing except to provide halved splices 6 in. long at the ends. The recommended practices of the A. R. E. A. are followed closely. This guard timber or ribbon is laid flat and held in place by ¾-in. lag screws 11 in. long in every tie. The ties are all sized for height and where cover plates give a variable dimension from top of steel to bottom of rail the ties are dapped to fit. In addition, they are grooved to clear rivet heads and every third tie is drilled for 13/16-in. holes for hook bolts and both the ties and guard timbers are drilled for lag screw holes providing ¾-in. holes in the guard timbers and ½-in. holes 5 in. deep in the ties.

Based on Field Measurements

The renewal of the bridge deck originates with recommendations from the master carpenter and following the authorization of the work, the division engineer prepares requisitions as well as detailed drawings and bills of material covering the framing and boring required. Required dimensions are determined by actual measurements taken in the field. Levels are taken across the bridge to determine the elevation of the top of steel at the location of each tie and the required depth of each tie is determined by subtracting this elevation from the actual or computed elevation of the base of rail at each tie. This insures that the tie as ordered will give the desired surface on the track with vertical curves where required and the necessary compensation for camber in bridge spans, etc.

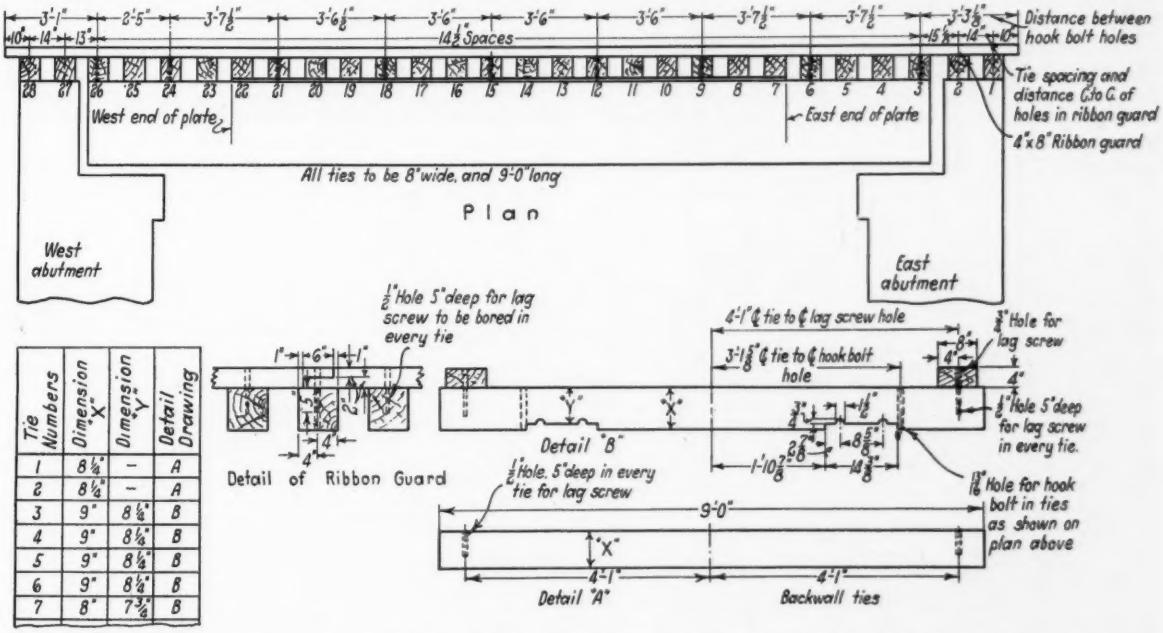
The requisitions show the number and sizes of the pieces required and serve simply as information in the purchase of materials. The information as to framing and marking of the timbers is supplied by special drawings for each bridge deck job. This gives an erection diagram which shows the number, position and spacing of all ties. The ties on each bridge are numbered consecutively from east to west, No. 1 tie being the first tie at the east end of the bridge. This diagram also gives spacing dimensions which definitely fix the location of each tie. There is also a table giving the number of each tie, its total depth, its neat or sized depth at the dap, and a reference letter to the particular detailed sketch appearing on the drawing which is to be followed with respect to that particular tie. These sketches also show clearly what holes must be drilled in the ties. No lengths are shown for the guard timbers so that the mill may use any length of timber available in making the guard timbers, it being only necessary to cut them to such lengths as to bring each splice over the center of some tie.

Each Piece is Marked

For the purpose of identification and convenience in shipment and erection, each timber for a bridge is marked on the end by branding hammers with identification marks that give all necessary information. This marking covers three items. The first embraces two letters descriptive of the division, as KD for Kent division, AY for Allegheny division, MC for Marion and Chicago divisions, etc. The second item is the bridge number and the third is a symbol showing the location of the piece in the deck. In the case of ties, this is simply the number of the tie from the east end of the bridge, followed by the suffix "E" or "W" to indicate whether it is in the eastbound or the westbound track where the authority covers the renewal of the deck in both tracks of the double-track bridge at one time. The guard timbers, instead of being numbered, have their splices numbered, the first splice being No. 1, the second No. 2, etc., from the east end of the bridge. Pieces for the north guard timbers are given a prefix "N" and those for the south side a prefix "S."

This system has proved thoroughly effective and no difficulty has been experienced in having the framing mill furnish the material in strict accordance with instructions. The material is not shipped direct to the job after treatment but is assembled in a storage yard on the road where it seasons while being held for shipment out to meet the work schedule requirements of the bridge gangs. This insures the incidental advantage of reduced fire hazard of the treated timber at the time that it is placed in the structure.

Framing before treatment, besides possessing the advantage of avoiding injury to treated timber by cutting it to do the necessary sizing after treatment, facilitates the work of renewing the bridge decks and it is carried on more quickly. The track on bridges has a better surface than when the sizing was done by the carpenter forces from measurements taken during the course of the work. There is also the further economy of a saving in material through the ordering of ties to more nearly the exact thicknesses required. Where sizing is done on the ground after delivery it is common practice to order the ties all of one size with a sufficient thickness to insure that the depth will be adequate for all cases, but where the sizing is determined from calculated figures which are all tabulated in advance ordering, it has been found possible to order shallower ties for those parts of the bridge where the finished depth is less.



Tie Numbers	Dimension "X"	Dimension "Y"	Detail Drawing
1	8¼"	–	A
2	8¼"	–	A
3	9"	8⅛"	B
4	9"	8⅛"	B
5	9"	8¼"	B
6	9"	8¼"	B
7	8"	7⅞"	B

Type of Drawing Prepared in the Division Engineer's Office for Ordering Framed Floor Timbers

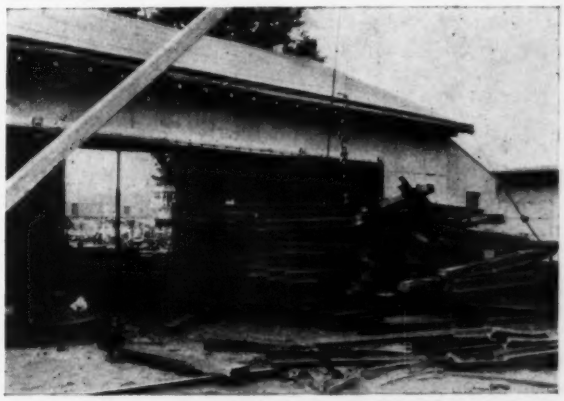
One of the objections which were raised when the adoption of the methods described above was under consideration, was the long delay it would introduce between the time that need for the renewal of a bridge floor was determined and the date on which the preframed treated timber could be delivered. Oak timbers of the sizes used in bridge decks require approximately one year for air seasoning, so that with all elements considered approximately 18 months would elapse from the time that the necessity for the renewal of the bridge deck was determined until the new timber could be applied and it was generally considered that this interval was too great.

The Boulton Process Shortens Time of Seasoning

To overcome this objection arrangements were made with the Joyce-Watkins Company, Chicago, which supplies the treated material, to treat the timber in the green condition by the Boulton process. Under this process the ties are immersed in creosote which is heated to the boiling point by means of steam pipes after a vacuum has been drawn. This "boiling" in creosote is effectual in removing the moisture from the ties and timbers without the splitting or checking that takes place during air seasoning.

Subsequently, however, the Erie has found it practicable to purchase timber and make proper inspection sufficiently in advance of requirements to permit air seasoning for an adequate period so that it would not be necessary to incur the additional expense of the Boulton process in treatment. It is now proposed to make a comparison of the cost of using air seasoned material with that of material treated by the Boulton process, taking into consideration the interest on the investment for holding material in storage for a greater length of time and the losses due to greater splitting and checking on the one hand, and the increased cost of treatment on the other. It is the practice with all bridge timbers to give them a 12-lb. Rueping treatment with No. 1 creosote oil regardless of the seasoning process, the amount of oil absorbed in the Boulton process being included in the total of 12 lb. retained.

We are indebted for the above information to I. H. Schram, regional engineer, Erie, Chicago.



A Frog Reclamation Plant on the Atlantic Coast Line at Savannah, Ga.

Careful Planning Enables Turntable to be Renewed in Short Time

Replacement of 80-ft. Balancing Structure with 115-ft. Twin Span Type Introduces Many Complications

By H. H. HARSH
Division Engineer, Baltimore & Ohio, Pittsburgh, Pa.

THE REPLACEMENT of an 80-ft. turntable by one 115 ft. long comprises a greater change in the length of turntables than is ordinarily made in the renewal of such facilities. It therefore introduces difficulties which are not ordinarily encountered and which demand the preparation of an unusually complete schedule for the performance of the various steps necessary for the completion of the work with a minimum interference with the operation of the roundhouse served by the turntable. This applies not only to the preliminary work carried out concurrently with the normal operations of the house, but also to the actual change during which no engine can enter or leave the house. This was the nature of the problem which was imposed on the forces of the Baltimore & Ohio at the Glenwood, Pa., engine terminal when the assignment of Santa Fe and mountain type locomotives to the Pittsburgh division demanded provision for a longer turntable.

The turntable serves a roundhouse of 25 stalls and eight radial tracks in the open, designated as tracks 29 to 36, inclusive. Three tracks, Nos. 26, 27 and 28, approach the turntable from the east and two tracks, Nos. 37 and 38, lead to the table from the west. Owing to the close proximity of the transportation yard, there was no unoccupied space that could be used as a material yard for the construction work. Consequently, the space occupied by the Tracks Nos. 29 to 36, inclusive, was used for the storage of materials and the adjacent engine storage track was used as a material and work track.

To reduce interference with the operation in the roundhouse, the new circle wall was built in sections, that in front of Tracks 29 to 36 being considered as Section 1, which was built first. The second section embraced Tracks 20 to 28; the third, Tracks 12 to 19; the fourth, Tracks 6 to 11; and the fifth, Tracks 37 to 5. During the work on the first section the gangs were organized and detailed methods of handling the work were being decided upon. This arrangement enabled the gangs to become efficient by the time Section 2 was started, and this resulted in the least delay to the motive power operation during the remainder of the work.

Type of Turntable Imposed New Problems

The new table is of the Bethlehem twin-span type in which the load is carried on the end carriages as well as the center while turning. The load-carrying construction consists of two separate simple girder spans with a plain butt connection through which they are bolted together over a center bearing of the bronze disc type. The outer ends of each of these girder spans rest on two trucks or carriages. One of these trucks for each span has two standard 33-in. car wheels with flanges turned off and mounted on standard M.C.B. car journals with 5½-in. by 10-in. brasses. The other truck is similar, except that it has added to it a 25-hp. motor and a set of gears for driving the truck.

When the table is in operation there is no rigid connection between the girders and these trucks, the trucks being held in alinement by two projections on plates fastened to the bottom of the girder which fits into corresponding recesses in the truck frame of each truck. The power to operate the table is carried to an overhead arch of standard clearance dimensions, located at the center of the table, through an oil collector switch.

It was decided that the table could be set in place more readily as a single unit rather than to set each span separately. As the girders of the two spans are entirely separate except for the bolting through a butt joint, it was necessary to provide bolted splice plates for the top and bottom flanges of the girders at the center joint in order that the girders of the two spans would take bending moment as a continuous span while being lifted into place as a single unit. To avoid having to set the table on nine points, eight on the four trucks and one on the center, the trucks were held up against the bottom of the girders by passing rods through the truck frames to timbers carried across the tops of the track rails on top of the table.

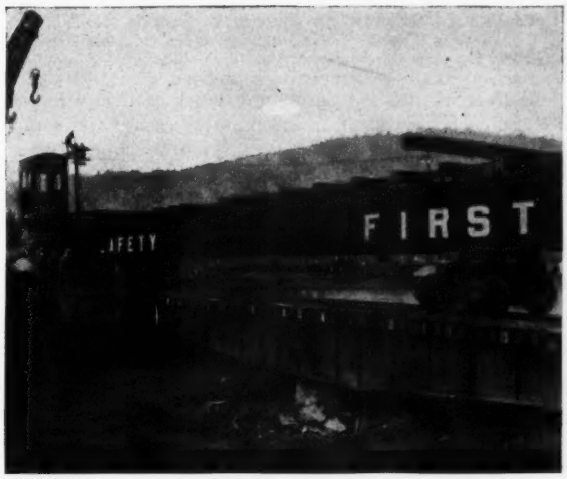
Mount New Turntable On Car Trucks

The entire assemblage of girders, fastened together, with the four trucks attached, with the track ties, rail and operator's cabin in place, was mounted on two car trucks, spaced 63 ft. center to center so that it would be possible to run the entire outfit on the old 80-ft. turntable and turn it. This complete assemblage was stored on the engine storage track at Point "Z" shown on Diagram No. 1 until the time for the transfer arrived.

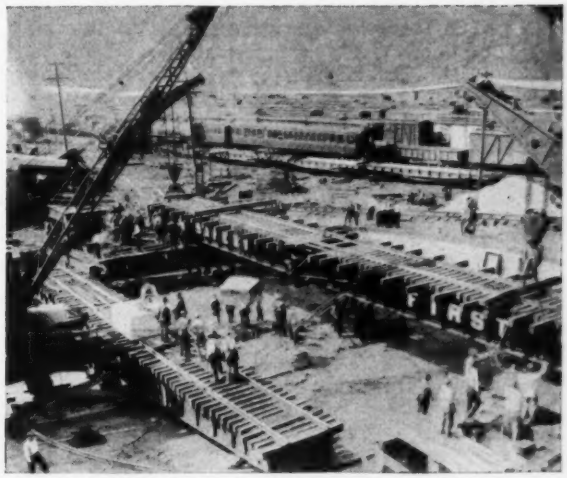
Monday, July 12, 1926, was the day set for the making of the change, but on Saturday, July 10, certain preliminary steps were taken, chief among which was the releasing of Tracks 13 and 14 from service, and the placing of an empty gondola car on Track 13, after which the new overhead arch was set between Tracks 13 and 14 against the gondola car. Material for a temporary trestle to extend Track 15 from the old circle wall 20 ft. towards the center was stored on Tracks 13 and 14. The new granite center stone and the new center bearing were also stored on Tracks 13 and 14.

On Monday at 6:10 a. m. all live engines were removed from the house and Tracks 4, 8, 10, 12, 15, 17, 18, 20, 22, 24 and 25 were left vacant for such use as it was desired to make of them in the handling of the construction operations. This left six tracks available for the use of the roundhouse forces on engines not to be used before evening.

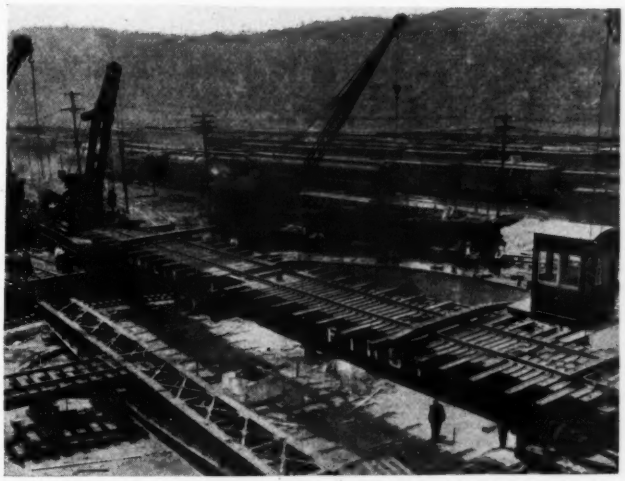
As soon as the roundhouse was released the construction forces moved in the equipment which it



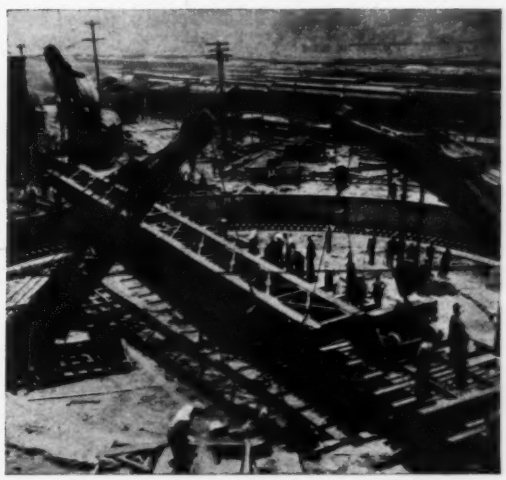
The New Turntable Mounted On Car Trucks, Being Rolled Out On the Old Table



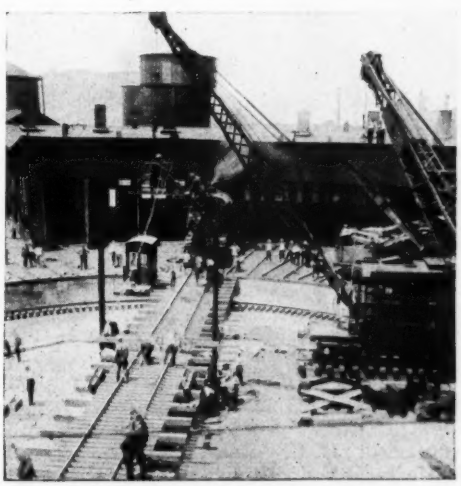
The Locomotive Crane On Track 15 Removed the Old Center and Center Stone



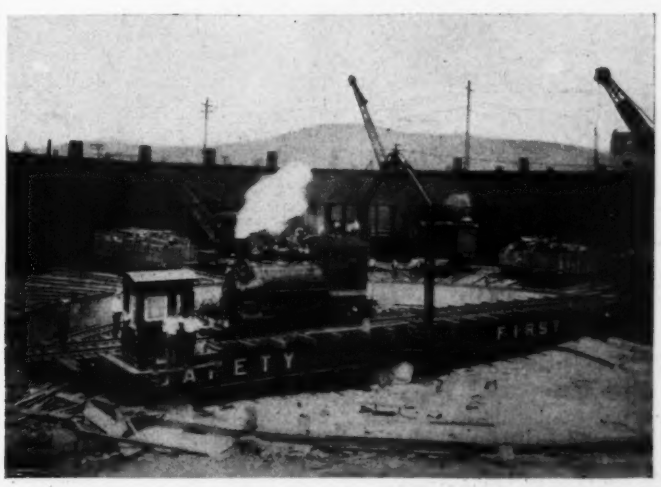
After the New Center Was in Position the Two Derricks Picked Up the New Turntable and Set It into Place



The Old Turntable Was Set On Car Trucks On the New Turntable and Rolled Out of the Way



Erecting New Overhead Arch. Space Inside the Circle Clear of Falsework Material



An Engine Was Used to Remove Equipment from the Roundhouse Tracks. This View Shows the Equipment Used in the Work

was planned to use in making the change. This consisted of three locomotive cranes, two wrecking derricks, one ditcher, four locomotives and ten gondola cars. The placing of this equipment, as shown in Diagram No. 1, was completed at 6:40, at which time the fourth engine, No. 2544, started to move the new turntable from the engine storage tracks to

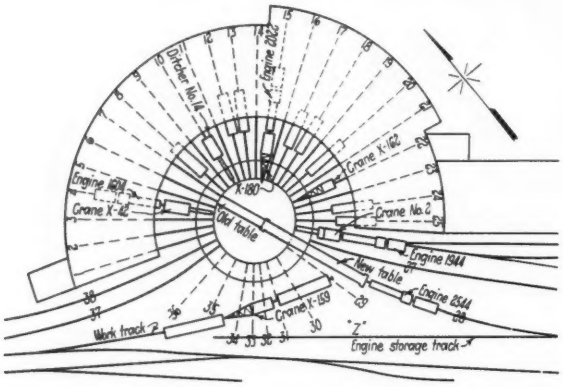


Diagram 1. Arrangement of the Construction Facilities at the Time That the New Turntable Was Rolled in On the Old One

Track 28 for the purpose of setting it on the old turntable. The remaining operations are tabulated below.

Schedule of Operations

At 7 a. m. the cranes and ditcher started the removal of temporary supporting trestles between the old and new circle walls. After the new table was balanced on the old table it was turned 170 deg. so as to bring it in line between the two derricks on Tracks 4 and 26. In this position the motor trucks and the operator's cabin were to the south side of the new table.

At 8:04 a. m. the two derricks lifted the new table from the two car trucks, and after the load was taken off the car trucks the old table was turned so that the east truck was taken off by Crane X-162 and the west truck by Crane X-159.

At 8:20 a. m. the new table was landed by the two derricks

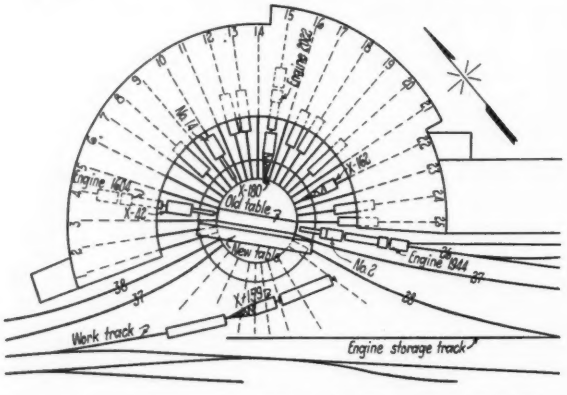


Diagram 2. Arrangement When the New Turntable Was Set On Blocking 16 Ft. South of the Old Turntable

on blocking on top of the new circle wall, 16 ft. south of the center line of Tracks 4 and 26.

At 8:35 a. m. two of the cranes and ditcher started the removal of the old circle rail and blocking under it, while Crane X-180 placed the extension trestle for Track 15.

At 8:39 a. m. the controller and tractor were removed from the old table by Crane X-159.

At 8:57 a. m. the two derricks lifted the old table off the old center and at 9:01 a. m. set it 14 ft. to the north of the center line of Tracks 4 and 26 and slightly west to clear Tracks 24 and 25, used for outrigger supports to Derrick No. 2.

At 9:16 a. m. Crane X-180, working from extension trestle to Track 15, over the top of the old turntable, had completed the removal of the center casting and stone.

As soon as this was done the work of dressing off the concrete foundation immediately under the old center stone proceeded. Meanwhile the cranes, ditcher and derricks continued the work of removing all falsework from inside of the new circle wall except for Track 15 and also removed the walk, rails and ties from the old turntable.

At 10:40 a. m. the foundation was ready and Crane X-180, working from the extension to Track 15, started setting the new granite block.

At 10:50 a. m. this same crane set the base plate and new center casting.

At 11:05 a. m. the two derricks picked up the new turntable and at 11:45 a. m. had landed it on the center and circle rail, and the work of removing the splice plates and rods supporting the trucks was started. This was followed by spacing and spiking the ties at the center of the new turntable.

At 11:55 a. m. the car trucks, on which the old turntable girders were to be loaded, were placed on the new table, and at 12:30 p. m. the old turntable girders were picked up by the two derricks and landed on these two car trucks.

At 12:50 p. m. the old table was moved off the new table by the work train handling Derrick No. 2.

At 12:50 p. m. Crane X-180 started to set the overhead arch on the new turntable.

At 1:05 p. m. Engine 1604 and Derrick X-42 passed over the new turntable from Track 4 to 26, after which the two derricks loaded the old turntable girders on flat cars ready for shipment to the Martinsburg, W. Va., shops for repairs.

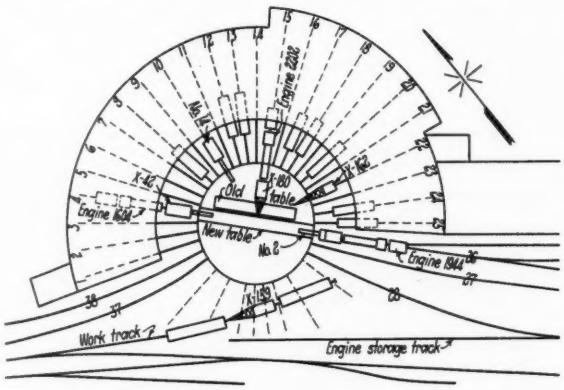


Diagram 3. The Old Turntable Was Placed in a Temporary Position 14 Ft. North of Its Original Position and the New Turntable Was Set Into Place

At 1:08 p. m. the overhead arch was fully bolted to the new turntable, and at 1:33 p. m. the power line was extended to the arch.

At 1:39 p. m. Crane X-180 had completed the removal of the extension to Track 15 and all falsework work under that track.

At 1:45 p. m. oil was placed in the overhead collector on top of the arch, and at 1:47 p. m. a test move of the new table was made.

At 1:55 p. m. the new turntable was placed in service, and Engine 72 removed the special equipment from the house.

At 2:16 p. m. Engine 5090 was turned.

At 2:43 p. m. Engine 4040 was turned.

At 3 p. m. all special equipment had been removed from the roundhouse and the house was ready for full use by the motive power department.

The work was handled under the direction of the writer, assisted by H. N. Anderson, assistant division engineer; T. F. Donahoe, general supervisor; D. C. McGregor, supervisor; H. L. Forney, master carpenter; and C. L. Sensheiser, terminal trainmaster, as well as a number of maintenance of way foremen, two wreckmasters and an electrical construction foreman.

Roadmasters Convene at Chicago

Large Attendance and Excellent Reports Contribute to Successful Meeting at Chicago

THAT the Roadmasters' and Maintenance of Way Association is a growing concern which enjoys the high esteem of the railway managements was clearly evident to everyone who attended the forty-fourth annual convention held at the Auditorium hotel, Chicago, on September 21, 22 and 23. The attendance was large, about 350 roadmasters, division engineers and other supervisory maintenance of way officers being registered, in spite of a protracted period of rain storms in many parts of the country which might have easily afforded an excuse for holding many maintenance of way officers on their respective properties. Ranking railway officers, headed by R. H. Aishton, president of the American Railway Association, who spoke on Tuesday morning, contributed in large measure to the success of the convention by the presentation of papers and addresses to supplement the five reports submitted by standing committees of the association.

While much of the program was devoted to technical phases of track maintenance, the primary theme at this convention was essentially the maintenance of way employee and the problems which arise from his employment. Thomas H. Carrow, supervisor of safety, Pennsylvania System, and chairman, Safety Section, American Railway Association, presented an address on Safety in the Maintenance of Way Department which bore fruit in the adoption of resolutions by the association pledging support in the campaign of the American Railway Association for a 35 per cent reduction in accidents by 1930. J. S. Hyatt, general manager of the Chicago, North Shore & Milwaukee, gave an interesting talk on "Building Morale Among Maintenance of Way Forces," an abstract of which will appear in a later issue. The report of the Committee on Rearrangement of Track Work to Promote Uniform Forces Throughout the Year, together with a paper stressing the importance of uniform forces by Lem Adams, maintenance assistant, president's staff, Union Pacific, touched on another phase of the employment problem which was actively discussed from the floor of the convention.

In addition to these features and four other committee reports, the program for the five regular sessions of the convention included a paper by H. J. Pfeifer, chief engineer, Terminal Railroad Association of St. Louis, on "The Effect of Modern Locomotives on the Length of Turnouts," and an address by John Foley, forester, Pennsylvania, appealing for greater co-operation on the part of the track man in checking the degree of adherence to specifications in the cross-ties delivered to them. Mr. Foley's talk also bore fruit in the adoption of a resolution pledging the co-operation of the members in giving greater attention to the quality of cross-ties they receive.

G. W. Morrow

President

Mr. Morrow is a product of an eastern railroad, the New York, New Haven & Hartford, on which he was employed for 22 years. Commencing as a timekeeper in 1904, he served as a foreman for a number of years and for some time prior to his election to the presidency of the Roadmasters' Association was a track supervisor, with headquarters at New Haven, Conn. During the past year he left the railroad to join the sales staff of a well known supply company, but in compliance with the wishes of the association's executive committee, he consented to serve in his executive capacity until the close of this convention.

At an evening meeting on Tuesday, J. V. Neubert, engineer maintenance of way, New York Central, Lines East, New York, presented an illustrated lecture on "Modern Track Construction and Its Development," while on Wednesday evening, upon the occasion of the annual dinner of the Track Supply Association and the Roadmasters' Association, the principal feature of the program was a paper by C. A. Morse, chief engineer, Chicago, Rock Island & Pacific, which carried the title, "Placing the Track Department on a Business Basis," and which owing to the illness of Mr. Morse was read by R. H. Ford, assistant chief engineer. The concluding feature of the dinner was an eloquent tribute by P. J. McAndrews, roadmaster, Chicago & North Western, to W. C. Kidd, secretary-treasurer of the Track Supply Association during the entire 15 years of the life of that association, who played an important part in 19 consecutive conventions of the Roadmasters' Associa-

tion, but was unable to attend this year on account of serious illness.

An interesting inspection trip was made by the roadmasters and their friends on Thursday afternoon. Through the co-operation of the management of the Illinois Central, a special train was provided for a trip through the Chicago terminals of that railroad, affording opportunity for the inspection of the extensive terminal improvements, electrification work and the new Markham yard, where opportunity was given to witness the operation of two types of car retarders.

The presiding officer was President G. W. Morrow, until recently supervisor, New York, New Haven & Hartford, New Haven, Conn. He was assisted by Vice President J. B. Kelly, general roadmaster, Minneapolis, St. Paul & Sault Ste. Marie, Minneapolis, Minn.; and J. P. Davis, engineer maintenance of way, Central Indiana, Anderson, Ind. T. F. Donahoe, general supervisor of road, Baltimore & Ohio, Pittsburgh, Pa., is secretary, and James Sweeney, supervisor of track, Chicago & Eastern Illinois, Danville, Ill., is treasurer. The members of the executive committee were C. J. Coon, supervisor, New York Central, New York; E. E. Crowley, roadmaster, Delaware & Hudson, Oneonta, N. Y.; H. R. Clarke, general inspector permanent way, Chicago, Burlington & Quincy, Chicago; P. J. McAndrews, roadmaster, Chicago & North Western, Sterling, Ill.; R. L. Haring, track supervisor, Long Island, Jamaica, N. Y.; M. Henry, supervisor, Chicago & Eastern Illinois, Villa Grove, Ill.; E. Keough, formerly assistant engineer maintenance of way, Canadian National, Montreal, Que.; C. H. Gruver, roadmaster, Chicago, Rock Island & Pacific, Manly, Iowa; W. F. Muff, roadmaster, Atchison, Topeka & Santa Fe, Newton, Kan. (past president); and E. T. Howson, editor, *Railway Engineering and Maintenance*, Chicago.

R. H. Aishton Addresses Convention

In considering some of your own problems let us take first, for instance, the growth of the load on the roadbed—not concentrated axle loads, but the total tonnage handled over the railroads and the great increase during the past five years. In 1921 the average in this country was 9,530 gross ton-miles per mile of main track per day. During the first six months of this year it was 11,756 gross ton-miles. Making allowance for the heavier traffic during the second half of this year, there will be this year, compared with 1921, an increase of more than 30 per cent of the load per day that the tracks you build and maintain has to carry.

During the year 1925, the railroads purchased for their tracks 2,179,201 gross tons of steel rails and 21,672,754 cu. yd. of all kinds of ballast (not including the ballast hauled from their own gravel pits, quarries, or power plants). Now these figures don't mean anything to the ordinary mind, but to illustrate the ballast item above, picture a pile of ballast that is 840 ft. long, 840 ft. wide, and 840 ft. high.

The past year has seen some outstanding accomplishments in maintenance. The adoption of the 39-ft. standard steel rail should and will be far reaching in its effects in producing economy. The new method of conserving the rails, the recommendations as to the canting of rails by the A. R. E. A.; the increasing use of preservatives in the treatment of ties; these are all outstanding things. These are all improvements over what was done before and the whole growth is towards better maintenance.

I believe the future development of the next few years lies in the development of labor saving devices and equipment. This is so in every other industry and is bound to be so, and is so, in the railroad industry, and with the development along these lines come better methods of doing the work, more economical methods of doing it and, above all, it brings about a stabilization of employment which has not existed in the past.

Now consider your interest in all of the problems of the railways, for we haven't the same problems we had a few years ago. The great problem then was whether the railroads were going to be able to continue under private management, but you don't hear much about that question these days. You are, however, hearing continually about the future of waterways, motor trucks, motor buses and even of airplane transportation in competition with the railways. What is the answer to all these things? Why, the answer as I see it, is to be continually more efficient, to continually render more and more adequate service to the public and to render such service at the lowest possible cost that can be produced through your efforts and ingenuities. If these things are done you need not fear the future of the railways, for in the hands of you men and those under your supervision lies, in part at least and no small part, the answer to these questions. If you do your part and do it well, public opinion and appreciation of the patrons of the railroads will do the rest.

One other word of advice to your organization. You discuss a lot of matters here, your committees give a great deal of time and thought to these matters, they have reached conclusions and formed recommendations. You discuss them here and you vote on them, and probably vote unanimously on most of the things. Don't go away and forget them, for here your work has only begun; you have got to make them effective. If you believe they are good things and if they are in the line of more efficiency and adequate transportation or greater economy don't drop them after leaving here but do everything to sell them to your own organizations and sell them to yourself, if necessary.

Address of President Morrow

During the three-day convention you will listen to the reports that have been prepared by your various committees. These reports are the backbone of the convention. This is your meeting and if you support it by entering into discussion, stating your experience, giving new thought or ideas as worked out by practical experience, you may be assured that you will take home with you information of much value to yourselves and to the railroads that sent you here. It would be well to make notes of what is said in order that you may be in a position to make an intelligent report to your respective roads.

In addition to your committee reports, there have been added to our program several addresses that will be delivered by men who have gained prominence and are holding leading positions with the railroads. These talks will be interesting to our members and further the educational value of our meeting.

It might be interesting for you to know that men of the maintenance of way department such as roadmasters, division engineers, etc., have contributed more men to the ranks of the leading executives of our railroads than any other department in railroad work. In order that you may know how much is thought of the work done by the roadmasters in conventions, by men in charge of the maintenance of our railroads, I will add that there has been an increasing demand for the proceedings of our meetings for distribution

to men who are not fortunate enough to be members of this association.

We are progressing each year and improving the methods of increasing the output of work by more efficient practices and labor saving devices. Every man in charge of maintenance should do his share. The Track Supply Association has added to the educational value of this association by exhibiting a splendid array of track accessories and labor saving devices, and it will be well worth your time to visit the booths.

Closing Business

The growth of both the Roadmasters' and the Track Supply associations during recent years has imposed an increasingly difficult problem on those charged with the perfection of arrangements for the annual conventions and exhibits, owing to the fact that only a relatively small number of hotels can offer facilities of adequate size for these two coordinate features. This problem has now been appreciably simplified by the passing of an amendment to the constitution of the Roadmasters' Association, conferring on the Executive Committee authority to select the place of meeting for each succeeding convention from one of three cities for which the association expresses preference by ballot at the close of the convention. In the vote on the meeting place for the 1927 convention, Buffalo was the first choice, Chicago second, and San Francisco third. An amendment submitted for the purpose of effecting a change in the date of the annual convention from September to November failed to receive the necessary two-thirds vote.

The report of the secretary-treasurer showed that the balance on hand in the treasury at the time of the convention totalled $1,634.88 as compared with $1,151.56 at the corresponding time last year. The present membership is 1,049 active members which, with 46 members of other classes, brings the total membership to 1,095 as compared with 1,023 last

The Committee on Subjects offered the following as tentative assignments to committees for the ensuing year for report at the next convention: (1) The rearrangement of track work to promote uniform forces throughout the year (2) the collection and use of cost data; (3) the training of track men as a means of preventing accidents; (4) the track department's share in the reduction of stocks of materials; and (5) means of reducing work train service.

The following officers were elected for the ensuing year: President, J. B. Kelly, general roadmaster, Minneapolis, St. Paul & Sault Ste. Marie, Minneapolis, Minn.; first vice-president, J. P. Davis, engineer maintenance of way, Central Indiana Railway, Anderson, Ind.; second vice-president, H. R. Clarke, general inspector of permanent way, Chicago, Burlington & Quincy-Colorado & Southern, Chicago; members of Executive Committee: For four years, A. E. Preble, supervisor, Pennsylvania, Middletown, Pa.; F. J. Meyer, assistant engineer, New York, Ontario & Western, Middletown, N. Y.; for two years (to succeed H. R. Clarke), C. W. Baldridge, assistant engineer, Atchison, Topeka & Santa Fe, Chicago.

Accidents to Maintenance of Way Employees

By THOMAS H. CARROW

Supervisor of Safety, Insurance Department, Pennsylvania Railroad; Chairman, Safety Section, American Railway Association

OUT of a total of 400,000 employees in the maintenance of way department on Class 1 railroads 428 were killed and 26,011 were injured in 1924, representing 31 per cent of all accidental deaths and 22 per cent of all injuries to employees. It is therefore apparent that the maintenance of way department, particularly the roadmasters association, should contribute a large share toward the 35 per cent reduction in railroad casualties by 1930, the goal established by the safety section of the American Railway Association at its annual meeting in 1923.

The railroads of the United States traverse 250,000 miles of territory, embracing 400,000 miles of track. They own 2,400,000 freight cars, 60,000 passenger equipment cars and 70,000 locomotives; they employ 1,800,000 men, 24 per cent of whom are in the maintenance of way department, and in the year 1924, which is typical of other years, 935,000,000 passengers and 2,260,324,000 tons of freight were carried.

With such an enormous volume of freight and passenger business, with such a mass of material things in the plant, all subject to failures that may cause accidents and with such a vast army of employees, all susceptible to errors that may result in death or injury, strict attention to safety is obviously necessary. That the railroads have not been remiss in this direction is indicated by a reduction in casualties of 32 per cent in 1925, compared with 1913, the peak year in personal injury accidents. While this performance reflects credit upon the managements of the railroads, analysis of the accident record shows clearly that a still further reduction should be made.

Injuries to maintenance of way employees, as reported to the Interstate Commerce Commission and the hours worked in 1924 on the Class 1 roads, are classified by occupations in Table 1 (1924 is the last year for which figures are available).

Three hundred and twenty-nine, or 77 per cent of the total number of maintenance of way employees killed and 22,136, or 85 per cent of those injured, were carpenters and laborers. It is therefore apparent that the greatest amount of effort to prevent accidents must be directed toward these two occupations.

Injuries Classified

The majority of the injuries to maintenance of way employees occur while handling rails, ties, lumber, timber and other material; handling and using hand tools; working on telegraph and telephone lines; operating hand and motor cars and in connection with the movement of trains as is shown by the classification of injuries by detailed causes given in Table II.

With the foregoing classification of injuries to maintenance of way department employees by occupations and detailed causes it is possible to develop certain principles of accident prevention practicable of application under the varying conditions of work.

What is safety? The dictionary says "freedom from danger," but that meaning is not applicable to railroad safety, because you can't be absolutely free

from danger on a railroad, although it is possible to be safe under even the most hazardous conditions. Therefore, in place of "freedom from danger" I would substitute "mastery of danger" as an appropriate definition of safety.

Mastery in the sense that it is here used means the development of a state of mind in which the precautions necessary to insure personal safety are automatic and constant. That thought is embodied in St. Paul's admonition, "Let him that thinketh he standeth take heed lest he fall." What is meant by mastery of danger will be better understood, however, by a few illustrations.

On a railroad employing about 4,500 maintenance of way and structures foremen 4 were struck and killed by trains in 1925. The ages of these foremen were 45, 47, 49 and 53, respectively. It seems incredible that men who had reached the meridian of life would sacrifice their lives in this manner. But, the explanation is not difficult to find, because these deaths were attributable to the fact that in a dangerous situation and in an unguarded moment they relaxed attention to safety. In other words the danger in which these men were caught and with which they were entirely familiar had not been sufficiently impressed upon their minds to insure constant or automatic precaution. They had not mastered danger. The same thing may be said of the 218 maintenance of way men, including 38 foremen who were struck and killed by trains in 1924. On the other hand there are many foremen on the railroads of this country who are so imbued with the necessity for keeping themselves and their men out of the way of moving trains that they are practically immune from accidents from this cause.

Table I—Injuries to Maintenance of Way Employees

Occupations	Killed	Injured	Total Man-Hours	Casualties per Million Man-Hours: Killed	Casualties per Million Man-Hours: Injured
1. Roadmasters and general foremen	4	50	8,516,000	0.47	5.87
2. Assistant general foremen	....	8	852,000	....	9.39
3. Supervising maintenance of way inspectors and scale inspectors	....	8	810,000	....	9.88
4. Maintenance of way inspectors	....	26	1,630,000	....	15.95
5. Bridge and building gang foremen (skilled labor) (1)	9	134	13,498,000	0.67	9.93
6. Bridge and building carpenters (7)	24	2,447	54,743,000	0.44	44.70
7. Bridge and building iron-workers	1	111	2,456,000	0.41	45.20
8. Bridge and building painters (1)	5	171	5,913,000	0.85	28.92
9. Masons, bricklayers, plasterers and plumbers	....	134	5,385,000	....	24.88
10. Skilled trades helpers (2)	9	637	24,351,000	0.37	26.16
11. Regular apprentices	....	43	285,000	....	150.88
12. Portable steam equipment operators (2)	6	144	6,101,000	0.98	23.60
13. Portable steam equipment operator helpers	2	71	2,353,000	0.85	30.17
14. Pumping equipment operators	4	126	17,698,000	0.23	7.12
15. Gang foremen (extra and work-train laborers) (2)	3	114	10,098,000	0.30	11.29
16. Gang foremen (bridge and building, signal and telegraph laborers)	1	92	1,605,000	0.62	57.32
17. Gang or section foremen (18)	30	965	102,289,000	0.29	9.43
18. Laborers (extra gang and work-train (18)	54	3,105	139,895,000	0.39	22.20
19. Track and roadway section laborers (153)	233	15,706	495,860,000	0.47	31.67
20. Maintenance of way laborers (other than track and roadway) and gardeners and farmers (6)	18	878	19,824,000	0.91	44.29
21. General foremen and supervising inspectors (signal, telegraph and electrical transmission)	2	7	1,267,000	1.58	5.52
22. Assistant general foremen (signal, telegraph and electrical transmission) and signal and telegraph inspectors (1)	1	12	1,508,000	0.66	7.96
23. Gang foremen (signal and telegraph skilled trades labor) (1)	1	25	3,167,000	0.32	7.89
24. Signalmen and signal maintainers (1)	5	380	20,896,000	0.24	18.19
25. Linemen and groundmen	9	259	6,551,000	1.37	39.54
26. Assistant signalmen and assistant signal maintainers	2	124	6,280,000	0.32	19.75
27. Signalman and signal maintainer helpers (5)	5	234	7,553,000	0.66	30.98
Total (218)	428	26,011	961,384,000	0.45	27.06
Total all classes of employees	1,403	120,912	4,472,049,000	0.31	27.04

Note: Figures in parenthesis include the number struck and killed by trains, which make up one-half of all fatal accidents to maintenance of way men.

Table II—Causes of Maintenance of Way Accidents—1925
Includes All Accidents of One Day's Disability or More.

	Estimated Injured
1. Lifting, handling, loading and unloading material and using hand tools, etc.—strain, wrench, sprain or rupture	2,070*
2. Lifting, handling, loading or unloading material—failed to take hold or let go in unison	190*
3. Ties and timber—lifting, handling, loading and unloading with unloader, derrick, etc.	90*
4. Ties and timber—lifting, handling, loading and unloading by hand	3,320*
5. Rails and frogs—lifting, handling, loading and unloading with unloader, derrick, etc.	440*
6. Rails and frogs—lifting, handling, loading and unloading by hand	3,790*
7. Other material—lifting, handling, loading and unloading with unloader, derrick, etc.	170*
8. Other material—lifting, handling, loading and unloading by hand	1,370*
9. Accidents in connection with use of jacks	700*
10. Spike drawer or bar slipping off spike, catching hands, etc.	1,100*
11. Driving spikes—spike flying up, etc.	460*
12. Struck by tools or materials in hands of fellow employees	660*
13. Hammer, sledge or other tool glancing or missing object	570*
14. Cut by adz or other edged tools	390*
15. Spalls flying off hammer, sledge, tool heads, etc. (including nut heads)	1,640*
16. Other accidents in connection with the use of hand tools	1,360*
17. Tamping ties—dirt or stone flying up	430*
18. Splinters or nails in hands or feet, etc.	570*
19. Poles, telegraph, telephone, electric light, etc., working on or around	290*
20. Slipping and falling on tracks, platforms, steps, ice, snow and from bridges, coal wharves, etc.	4,840*
21. Scaffold falling or giving way or falling off scaffold	110*
22. Ladders, falling or breaking or giving way or falling off ladder	100*
23. Opening or closing drop doors on cars—wrench slipped, etc.	160*
24. Poisoned by creosote	290*
25. Autos, teams, etc., colliding with crossing gates	20*
26. Struck or run over by locomotives or cars (I. C. C. 1924 figures) 218 killed	258
27. Hand cars or motor cars struck by trains (I. C. C. 1924 figures) 34 killed	90
28. M. W. & S. hand cars (non-train accidents only) (I. C. C. figures) 7 killed	1,069
29. M. W. & S. motor cars (non-train accidents only) (I. C. C. figures) 62 killed	3,341
(Causes 28 and 29 include derailments, men falling off, tools falling off, lifting, placing and starting, etc.)	
Total (includes miscellaneous accidents—not shown)	30,000*

Note: (*) Not possible to estimate accurately the number killed due to the respective causes.

Safety Is Mastery of Danger

It may be repeated then that safety is mastery of danger or the visualization and anticipation of danger which induces the exercise of the precautions necessary to prevent accidents. In other words, safety consists first in automatically seeing danger either with the physical eye or with the mind's eye and then getting out of the way of it or removing it. It therefore follows that the development and introduction of a system of accident prevention on each unit of the railroads and on the railroads as a whole that will insure the mastery of danger on the part of employees, is a fundamental necessity and the general causes of accidents and preventive measures tabulated on the next page are intended to form the basis of such a system.

A defective tie, a broken rail, a missing bolt, a blunt switch point, an improperly displayed signal, a defective part of the running gear of locomotive

or car, missing or defective safety appliances, lack of safeguards on machines, defective walkways, litter and rubbish on the tracks and other dangerous physical conditions may cause death or injury. However, it is estimated that only 5 per cent of all railroad casualties are in any way attributable to defective material and equipment, lack of safeguards, litter or other physical hazards.

It is nevertheless a fact that by uniform application of the preventive measures shown in the table, namely, improved design and construction, better maintenance and the installation of necessary safeguards, a substantial reduction in the present number of accidents due to dangerous or defective physical conditions can be made and for the most part without much additional expense, but simply by developing greater interest in safety.

Causes of Accidents and Preventive Measures

Causes	*Preventives*
A. *Physical Conditions:*	A. *Physical Conditions:*
1. Unsafe design and construction.	1. Improved design and construction.
2. Defective material and equipment.	2. Efficient inspection and maintenance.
3. Lack of safeguards.	3. Installation of necessary safeguards.
4. Litter.	4. Good housekeeping.
5. Other physical hazards.	5. Miscellaneous.
B. *Human Factor:*	B. *Human Factor:*
6. Violation of rules and other forms of negligence.	6. Proper training, supervision and discipline.
7. Carelessness, thoughtlessness, indifference and ignorance.	7. Safety organization, education, persuasion and co-operation.
8. Physical and mental unfitness.	8. Proper selection and placing of employees, first aid and medical attention.
C. *Misadventure:*	C. *Unpreventable:*

Accidents attributable to the human factor are classified under (a) Violations of rules and other forms of negligence, (b) Carelessness, thoughtlessness, indifference and ignorance, and (c) Physical and mental unfitness.

The most impressive fact disclosed by an examination of the record of accidents due to violations of rules and other forms of negligence is that some roads and some divisions of particular roads have much better records than others. The logical inference to be drawn from this fact is that the roads or the particular divisions or sub-divisions that have the fewest accidents due to violations of rules and other forms of negligence provide better training, supervision and discipline than those that have poor records, other conditions being equal.

This statement is substantiated by a check recently made on a division which has 2,000 maintenance of way employees. The check showed that during the 2½ years ended June 30, 1926, 20 foremen had no accidents; 19 foremen had but one accident each, and 23 foremen had but 2 accidents each, while 113 had from 3 to 27 accidents. With a stable working force there is no reason why accidents due to violations of rules, such as clearing trains promptly, and other forms of negligence cannot be practically eliminated on each division of every railroad just as they have been eliminated on specific divisions or sub-divisions and particular railroads.

It is estimated that 35 per cent of all injuries on the railroad fall under the classification of carelessness, thoughtlessness, indifference, ignorance or physical and mental unfitness and misadventure. The preventives of accidents arising from these general causes are safety organization, education, persuasion, co-operation and first aid and medical attention. There is not a body of railroad men on any division of any railroad in the United States that will not eventually become safe men if these methods are intelligently and continuously applied.

There is and always will be a small percentage of accidents attributable to misadventure, which are unpreventable but the number is insignificant and does not warrant further attention.

The Make-up of a Man

It is a common tendency to draw a mental picture of a mass of buildings, track, equipment and human beings when we think of the railroads as a whole, as well as when we think of our individual roads. The fact is that railroads are not operated by a mass of men, but by a large number of individuals, each of whom possesses a combination of characteristics peculiar to himself and whose best effort can only be brought forth on his specific job by bringing to bear upon him the proper sort of influences, and if there is any point that needs to be emphasized in safety work more than any other it is that only by bringing each individual into the safety fold can the entire organization be made safe.

A man may be studied and analyzed with the same particularity with which machines are and as a general indication of how it may be done the following chart is presented:

The Make-Up of a Man

Physical	*Mental*	*Moral*
Positive	*Positive*	*Positive*
Health	Understanding	Appreciation of the right
Strength	Judgment	Desire to do the right
Skill	Reason	Dissatisfaction with wrong
Quick to act	Keen perception	
Normal eyesight	Apprehension	
Normal hearing		
Negative	*Negative*	*Negative*
Disease	Natural limitations	Indifference
Weakness	Forgetfulness	Carelessness
Clumsiness	Dullness	Perversity
Awkwardness		Recklessness
Laziness		Don't care
Defective eyesight		Lack of precaution
Defective hearing		

The three principal parts of a man's being are (a) Physical, (b) mental, and (c) moral, and each part has a positive and a negative side. The extent to which the positive side is developed represents the degree of success achieved in rendering ineffective his negative side, the side to which nearly all accidents are attributable. Here the fact should be emphasized that it is impossible to eliminate negative tendencies or characteristics and the only way, therefore, to overcome them is through the development of the positive ones.

Health, strength, skill, "quick to act," good eyesight and good hearing are the principal elements of the physical man on his positive side, while disease, weakness, clumsiness, awkwardness, laziness, defective eyesight and defective hearing constitute his major negative physical characteristics. The first step, therefore, in securing men of proper physical condition is medical examination and selection of applicants suitable for the jobs to be filled. The second step is to provide working conditions conducive to health and strength and the third step is to see that the health and strength of employees are

conserved. With these several features attended to, disease and all the other negative characteristics of the physical man will be overcome as far as it is humanly possible and the accidents arising from impaired physical condition of employees will thus be minimized.

The railroads can draw up specifications for machine and material and thus obtain the kind desired, but when hiring employees all that can be done is to take the best available from those who apply for work. It is therefore important that the understanding, judgment, reason, perception and apprehension of those who are selected for employment be developed to the fullest extent. If this be done the negative side of the mental man, namely, natural limitations, forgetfulness and dullness will be overcome to a considerable extent and accidents attributable to these characteristics will be minimized. This feature of safety work obviously presents a large field for intelligent effort, particularly from the standpoint of individual instruction and supervision.

A man may be physically sound and possessed of a highly developed mentality with his moral nature undeveloped. This constitutes a serious impediment to safety. Fundamentally safety is right and proper and merits the moral support of everybody, but unfortunately there are many employees who do not appreciate this fact and are therefore indifferent to and take no active part in safety. In other words, the negative side of their moral nature; namely, indifference, carelessness, perversity, recklessness and lack of precaution, is developed in greater degree than the positive side. Hence the necessity for including in our safety activities ways and means of appealing to the moral nature of men in order that an appreciation of the right, desire to do the right and dissatisfaction with wrong may be developed. I am inclined to believe that the greatest results in safety may be obtained in this direction because love and appreciation of any kind of work makes it easy to do. After all, safety is not abstruse, nor is it difficult to understand, and perhaps no avenue of approach will lead more directly to success than the approach through the moral nature of railroad men.

Summary

We have analyzed the nature of the safety problem, indicated its extent, shown the general causes of accidents and oulined practical preventive measures. Finally we have undertaken to explain the "make-up of a man" to show how his positive characteristics may be developed and his negative characteristics rendered ineffective. With an amplification of the suggestions presented and an intensive application of the preventive measures outlined by every division of every railroad in the country the 35 per cent reduction in railroad casualties by 1930, the goal established by the Safety Section of the American Railway Association, will be assured.

To this end it is hoped that a committee will be appointed to formulate appropriate resolutions outlining specific action to be taken to prevent injuries in the maintenance of way department of the railroads of the United States and to be passed upon by this body before final adjournment.

Discussion

This address aroused active discussion. P. J. McAndrews (C. & N. W.) considered education as the most effective measure in the reduction of accidents. "It is the duty of supervisory officers," he said, "to analyze each accident to determine the cause, for there is a reason for every accident." Men should be impressed with the importance of taking proper precautions. Safety rails, adequate brakes, the proper loading of tools on motor cars and trailers, measures for the reduction of accidents in the operation of motor cars, are indicative of similar measures that may be adopted for the reduction of accidents of other kinds. He emphasized the fact that the heavy labor turnover is productive of accidents, stating that on those sections on which he maintains uniform forces throughout the year fewer accidents are incurred than on other sections with a larger proportion of new men. Among the measures in effect on the North Western is one of circularizing all foremen each month relative to accidents occurring during the preceding period. Each roadmaster is also furnished with a statement monthly showing his rating in comparison with other roadmasters in the number of accidents per million man hours worked.

Mr. Kelly has been a member of the Roadmasters' Association for the past 11 years and has taken an active part both in committee work and in the discussions on the floor of the convention, where his ability as a forceful speaker has attracted attention. He has seen 18 years of service in maintenance of way work as a foreman and a roadmaster, having been employed first on the Minneapolis & St. Louis and later on the Minneapolis, St. Paul & Sault Ste. Marie, of which he is now general roadmaster.

J. B. Kelly
First Vice-President

C. W. Baldridge (A. T. & S. F.) said that some men are prone to dangerous habits and that others must look out for those who will not look out for themselves. J. B. Martin (N. Y. C.) advocated that every roadmaster should so plan his work as to enable him to retain as nearly uniform forces as possible and thereby to reduce his labor turnover. He also advocated the more intensive use of equipment as a means of eliminating those injuries incurred in handling ties, rails and similar heavy materials. D. O'Hern (E. J. & E.) described the practice of his road of enforcing a 14-day safety drive each year to emphasize the importance of this subject. Among other measures which he has found to reduce accidents is that of coupling together motor cars hauling large gangs of men so that all of the cars are operated under the supervision of the foreman.

W. A. Davidson (U. P.) stated that in the last three months the safety agents on each division of that road had talked to every employee monthly on safety subjects. As a result there was not a single reportable injury on the Nebraska division during August, while the 175 track men under his immediate supervision have worked three months without a single injury. On this road special attention is given to the operation of motor cars, to the clearing of trains and to the concentration of attention of the

men on the work in hand. C. Feucht (U. P.) attributed the majority of motor car accidents to violations of rules. As a result of giving special attention to the operation of these cars, he has had no motor car accidents in four years and only two reportable accidents from other causes in this period among a force of 170 men. J. H. Dooling (B. & M.) urged that more consideration be given to the selection of proper equipment for the unloading of ties, especially when treated, as a means of reducing accidents.

The Effect of Modern Locomotives on the Length of Turnouts

By H. J. PFEIFER
Chief Engineer, Terminal Railroad Association of St. Louis

WHEN Mr. Coon of your executive committee spoke to me last March about the presentation of a paper to this convention on "The Effect of Modern Locomotives on the Length of Turnouts," I really had in mind a discussion of the track conditions that make possible the continued safe use of short turnouts and sharp curvature under the long and heavy modern locomotive. Particularly in the larger cities, track layouts developed and installed many years ago, some of them very extensive, are built with short turnouts and very sharp curves; it is usually impossible to lengthen the turnouts and ease the curvature, because this involves either a material reduction in capacity or the acquisition of additional land at great and sometimes prohibitive cost, with the necessary readjustment or destruction of expensive buildings and other facilities that have grown up in the vicinity. To fit up and maintain short turnouts and sharp curves, without change in alignment, to meet the requirements of the modern locomotive, is often of vital importance, because it may mean the continued useful life of a facility that might otherwise have to be replaced at great cost.

The St. Louis Union Station is an example of a situation, such as has just been described. As most of you know, there are 32 station tracks, running north and south at approximately right angles to the main lines with which they are connected to the east and the west by two three-track throats, making possible six simultaneous moves into and out of the station. An idea of the complexity of the track layout that makes possible all of these connections and parallel moves, is given by the fact that it contains 74 single turnouts, 51 slip switches, and 21 railroad crossings.

Sharp Curves Are Unavoidable on the Main Leads

The limited distance from the main lines, to the ends of the station tracks makes imperative the use of the sharpest possible curvature to secure tracks of maximum length to hold present day trains. The curvature of the main leads into the station is 16 deg. and the slip switches and turnouts are number sevens. There are a few crossover tracks with a curvature of 20 deg.

The tracks are used without restriction, except as to speed by the heaviest and longest passenger locomotives of 18 railroads in hauling about 260 regularly scheduled trains into and out of the station daily. This movement with the necessary switching of empty trains, light engines, etc., keeps the station tracks very busy, particularly at certain hours of the day. Since there is no possibility, short of complete abandonment, of equipping the station track layout with easier curves and longer switches, and locomotives are constantly becoming heavier and longer, it is necessary to maintain the station trackage to a very high standard, so as to handle this heavy movement with expedition and safety. While they are rare, derailments do sometimes occur. A study of them develops the following:

1. Locomotives derail much more frequently than cars.

2. In almost every case the derailment is at a frog, guard rail or railroad crossing while moving around a curve.

3. Very few derailments occur at switch points, or on curved tracks, where there are no frogs and guard rails, and a derailment on an unbroken straight track is almost unknown.

Derailments Have Been Almost Entirely Eliminated

As a result of the close attention given to maintenance of the station trackage, and the application of devices to correct defects exposed by a study of derailments during the past few years, there has been a decided reduction in the number of derailments; in fact they have been almost entirely eliminated.

A first requisite for good safe maintenance, particularly in switches and on curves, is a track that will stay put, in other words, one that will maintain its alinement, surface and gage under traffic. This can only be secured on a drained, substantial roadbed, well ballasted with good ties, tie plates and heavy rail. The station tracks, well drained, rock-ballasted with 100-lb. R. B. section rail, laid on sound ties with tie plates 8 in. wide by ¾ in. thick, are being maintained to true alinement, surface and gage at moderate labor cost. Some details of practice that have been found effective and made standard are the following:

As the speed is limited to a maximum of 20 miles

Mr. Davis has been a member of the association for the past 13 years, and his election to the position of second vice-president came as a recognition of his work as a member of the executive committee. His position in the railway field is that of engineer maintenance of way of the Central Indiana railway, one of the short lines in the central states. Like other small roads of limited staff, it imposes more extended responsibility on the maintenance officer than would be required of one in charge of an equivalent mileage of line on a large property.

J. P. Davis
Second Vice-President

per hour, all tracks, regardless of the curvature, are laid without super-elevation. The wear of a curved track invariably depresses the inside rail, therefore, a track laid level to begin with can go longer without attention than one that has had super-elevation built into it.

The Gage is Not Widened on Curves

A gage of 4 ft. 8½ in. is standard, regardless of the rate of curvature and is being maintained successfully. A detailed examination of the head of a rail that has been laid for some time on the inside of a curve, regardless of the rate of curvature or gage of track, becomes flattened and flows over on the gage side, proving that there is not the least flange wear on the inside rail of a curve. This indicates, and our actual experience has proven that widening of the gage on curves is unnecessary, and adds to the maintenance cost because all curved track becomes widened by wear, and if you begin with a widened gage, earlier regaging becomes necessary.

The Approaches to the St. Louis Union Station Require Short Turnouts

Since lubrication reduces friction, the daily oiling of the gage side of the outer rail on curves, of switch points, guard rails and frogs has been a practice of about three years standing. Such a material reduction in wear has been noted as to confirm our belief that this practice has proved economical and well worth while.

Since practically all derailments occur in turnouts and crossings, their improvement has been studied carefully. Much difficulty has been experienced in keeping railroad crossing frogs and turnout frogs, particularly on curves, in position, there being a decided tendency for them to slide between the spikes; in fact, on some sharp curves it was almost impossible to hold a frog in position. It has been developed that a guard rail, particularly a long guard rail opposite the guard on a frog and on a curved track, because of a narrow flangeway on each side of the track, restricts the movement of driving wheels held together in the frame of the locomotive to such an extent that without lateral movement of the entire track and alternate slipping in and out of the rail between the spikes a derailment can hardly be avoided.

About five years ago some of the lines entering the Union station began the use of a very long and heavy 4-8-2 type of locomotive, which at first caused so much trouble, while moving through switches on sharp curves, that it was necessary to restrict them to tracks with easier curvature. Very careful tests and studies of these locomotives and of the tracks were made to determine the possibility of using them with safety. It was found that the derailment of one of these locomotives invariably occurred in a back-up movement and that the back driver mounted the guard rail about two feet ahead of the frog point on a sharp curve. It was thought that this might be due to the cramping of the locomotive driving wheels between the guard rail and the guard on the frog, and as an experiment, a few self-guarded frogs were installed and the guard rails were removed. It was seen immediately that the movement of these locomotives was much freer and that there was no further difficulty in keeping the frog in its position. Since that time practically the entire station layout, including crossing frogs up to 28 deg. angles, has been equipped with solid cast manganese steel self-guarded frogs and these locomotives and others just as long and heavy have been moving in and out of the station unrestricted and without derailment ever since. Because of our satisfactory experience with the self-guarded frog, from the standpoint of safety and economical maintenance, it has been made standard on the entire terminal for all but high speed tracks.

Finally, the safe maintenance of sharp curves and short turnouts under long and heavy locomotives cannot be secured without careful and competent supervision, capable foremen and expert trackmen to discover and correct irregularities before they become too bad and cause trouble.

Discussion

J. B. Kelly (M. St. P. & S. S. M.) referred to the use of a gage of 4 ft. 8½ in. in the Union station tracks and the change in practice that had come about in this respect in recent years and to the tendency towards the use of shorter guard rails, both of which improvements were doing much to eliminate derailments on sharp curves. In reply to questions Mr. Pfeifer stated that only one road using the station had locomotives with blind drivers and that no trouble was experienced with them at the self-guarded frogs at the slow speeds permitted. He also stated that the solid manganese frogs used in

the No. 7 turnouts were short and were not curved for the lead, but that some of the longer frogs were curved on the lead side. W. Lawrenz (C. & E. I.) cited an instance where derailments on a transfer track having a 22 deg. curve were eliminated by taking out the superelevation of the curve. The use of frictionless rail for the inside of sharp curves was discussed and several members stated they secured the advantages of a narrow head by using curve worn rail.

The Construction and Maintenance of Highway Crossings and Their Approaches

REPORT OF COMMITTEE

NO DEVELOPMENT in the industrial world has been thrust upon us more rapidly than the transition from horse-drawn to motor-drawn vehicles. Motor vehicles have come to stay and to perform helpful and indispensable services. Their tremendous growth makes it necessary to maintain railroad crossings and their approaches at a higher standard, not alone to promote comfort in travel but to aid in the reduction of accidents at these crossings.

Two of these problems and doubtlessly the major ones are the construction of grade crossings and of their approaches with reasonable protection to promote safety. A highway crossing that will handle the heavy vehicular traffic, often running as high as 20,000 vehicles per day, and which can be repaired quickly and cheaply without the necessity of complete renewal, is the most practical crossing. The surface material must be elastic and resilient enough to absorb the impact and vibration without becoming permanently impaired. Equally important, the priority of right for the movement of trains over crossings as compared to pedestrian and vehicular traffic, implies an equal obligation on the railroad to provide suitable signs and protection. These problems call for united study and action by highway and railroad officers of this country and Canada. The diversity of efforts of different states with the same object in view, but entirely different methods, results only in confusion. Standardization of methods and practices should be obtained.

Crossings Should Not Limit Traffic

As to construction and maintenance, crossings and approaches should be of sufficient width with ease of approach as not to limit traffic on the highway. There are many methods of securing the necessary smooth surface, no small proportion of which are practically prohibitive because of their first high cost and subsequent maintenance charges. This condition has led to the development of a type of crossing in which a bitumen or similar compound is utilized. This general type of crossing has been found to give excellent results, being comparatively low in first cost, easy of application under traffic, readily repaired, low in maintenance and smooth in surface. The committee has, therefore, largely confined itself to a review of a number of installations of this general character, although attention was given to other forms, such as concrete, plank, brick, etc., following this by a study of approaches, including signs, to promote safety.

Bituminous Crossings

The expense resulting from the high maintenance costs of crossings utilizing planks, bricks, etc., has brought into the market a number of bitumens, the more common types of which are those made from:

1. Oil residues.
2. Emulsified asphalts.
3. Coal gas tars.
4. Mineral rock containing asphalt.

All of the above compounds are applied cold, a feature that is very desirable in the maintenance of way department. The methods used in applying mixtures No. 1, 2 and 3 are similar and the cost for labor and material is about the same. The No. 4 type is a natural rock which is pulverized by machinery and which contains enough asphalt to solidify when tamped in place.

The Bituminous Crossing Provides a Smooth Surface

The work of preparing the crossings for any of the bituminous materials is practically the same. The old ballast is cleaned out to a depth of at least one inch below the bottom of the tie. The inter-track spaces are generally lowered one foot below the

bottom of the ties to allow for tile or other suitable drainage.

The construction material should be unloaded as near as possible to the location of the work. All ties should be renewed throughout and rail relaid without any joints in the crossing, tie plates applied and full spiked and the tracks then brought to good surface and line. Flangeway guards are not necessary but it is impossible to get permanent results without the use of flangeway guards, of which several methods are used, namely; dapped plank, heavy timber, angle iron, old rail and the Newhall type. Material should be used generously but not lavishly, because many poor installations have been made by trying to save on materials.

The maintenance of bituminous crossings is simple, requiring the keeping of a few yards of ½-in. stone and a barrel of oil at some convenient place nearby and out of sight, where the track walkers or crossing watchmen can make repairs readily and easily.

The cost of installing these crossings varies according to the number of train movements, the density of vehicular and pedestrian traffic and the cost of labor and materials in the various localities. Bituminous compounds are now generally used by all of the railroads of this country and Canada, not only in complete renewals but in repairing and rebuilding existing crossings.

Although most of the roads follow the same general practice in constructing bitumen crossings, one road varies this by carrying a mixture to a greater depth. This road cleans out the old ballast to below the bottom of the tie, then puts in and thoroughly tamps clean ballast to within two inches of the top of the ties. The remaining height to one inch above the top of rail is then filled with a mixture of stone and bitumen. This is well rammed as it is built up and is given a final dressing of sand to fill the voids. A number of heavy track crossings have been built in this way, the repairs for which have been quite small in cost. It was the experience of this road that a top mixture of only three inches did not hold up well, often developing cracks and spalling out after a few weeks service, through which the dry stones work their way up as a result of the train vibration and heavy motor traffic.

Other Types of Crossings

A variation in the type of plank crossings is illustrated in the practice of one road, which uses short lengths of planks laid diagonally on furring strips. Flangeway guards are used, the furring strips being spiked to the ties about two inches from the guards and down the center line. These planks are sawed to a standard length, kept in stock and shipped out as needed for renewals. A further improvement of this type of crossing has been secured by leaving the planks low and coating them with a layer of rock asphalt, a bituminous paint being applied to the plank. This has resulted in a smoother surface, which can be easily repaired.

Another variation in plank crossings is illustrated in an experimental installation made recently on one of the large roads. This is a double track crossing where the vehicular traffic to and from a freight yard is unusually heavy. It is built up of second-hand switch timbers. These switch ties are carefully fitted to the track ties and spiked to the ties in conjunction with flangeway guards.

Several roads have built highway crossings with old rails, laying them workwise and longitudinally with the main track rails, then filling in with a bituminous mixture. This type of crossing gives permanency and the scrap rails can be salvaged at any time.

One large western road, to seal its bituminous crossings and make them waterproof, uses a rail of lighter section than the main track rail for a flangeway guard by spiking a furring strip or riser to each tie, spiking the light rail workwise and parallel to the main track rails and then filling in with a bituminous mixture. This avoids heaving in winter and spalling out along the running rail. Another interesting form of construction, called the guarded triple penetration bituminous crossing, was described in the June, 1926, issue of *Railway Engineering & Maintenance.*

Mr. Donahoe, who has been secretary for two years and served as treasurer for the three years preceding, has been a member of the association since 1910. Taking an active part in the Roadmasters' Association immediately after becoming a member, he was elected vice-president the following year and two years later was advanced to the presidency. He has always given freely of his time in the interests of the association. Mr. Donahoe is a Baltimore & Ohio man and for a number of years has been general supervisor of road, with headquarters at Pittsburgh, Pa.

T. F. Donahoe
Secretary

As a part of this report, the committee has prepared a series of brief descriptions of a number of road crossings using bitumen, located over a wide area. These are listed by materials. In general, the committee has confined itself to crossings over which there was a considerable heavy traffic. We recommend the increased use of bituminous materials to replace the existing crossings of plank, concrete, skeleton, brick, Belgian blocks, rails, etc., believing that the use of bitumens will overcome many of the defects and the high costs of the types mentioned.

These defects may be summarized briefly as follows:

Planks: High first cost and upkeep, danger to equipment, etc.

Concrete: High first cost, cracking, disintegration and difficulty of repair.

Skeleton: Unsuitability for heavy traffic.

Brick: High first cost and maintenance.

Belgian block: High first cost and maintenance.

Conclusions

The committee recommends that exceeding care be taken in the installation of bituminous crossings, particularly along the following lines:

1. Good line and surface of track.
2. Large ties, hardwood and treated, tie plated and fully spiked to prevent looseness and vibration.
3. Elimination of all joints in crossings.

4. Flangeway guards, except in crossings of the lightest traffic.

5. Generous use of bituminous material sufficient for a good binding mixture and an impervious crossing.

6. Provision for good drainage and upkeep.

The Construction of Approaches (Including Signs) to Promote Safety

The program of highway crossings, approaches and their protection will be with us for a long time for the tremendous cost necessary to eliminate them makes this a problem requiring careful thought. There are four elements to be considered: (1) Traffic on the highways, (2) traffic on the railroads, (3) vision of the tracks from the highway, and (4) grade, width and type of surface on approaches.

The conditions at a crossing should be studied by making a survey for a certain period, showing a count by hours of the motor, pedestrian and train movements. Then a vision survey should be made to determine such conditions as the obstruction to view, grades of approaches and the alinement of tracks. With this data before us, there is no reason for snap judgment. This done, one can then decide what kind of protection should be afforded. Protection is of two kinds, manual or stationary, and automatic.

The railroad crossing is identified by various kinds of signs on the right-of-way. In many states an approach sign is located 300 ft. from the tracks. Grade crossings are further protected by watchmen, using metal discs and lights at night. Crossing gates are painted black and white to increase visibility and attract attention, red lights being suspended on the gates at night. Other protection is afforded by wig-wag and flashing signals, operated electrically on the approach of trains. It might be interesting to know that the railway signal officers have established a rule whereby the length of circuit is determined by the speed of trains, the length in feet being usually 30 times the average speed.

Different methods are used by various railroads throughout the country to promote safety, many of which are connected to track circuits to operate lights and bells connected to signs. There are so many different kinds of these that tourists become confused or overlook them. The American railroads continue to make great strides toward safety movements and this committee would go on record as suggesting that a committee of safety agents in America and Canada be appointed to decide on one standard sign to be used on all heavily traveled highway crossings and another sign for less traveled country road crossings.

The great need is to bring about a sense of personal responsibility on the part of individual drivers. Pedestrians must do their part and officers must continue to devise better ways and means for enforcing sane and practical regulations. In the meantime simple rules of foresight and precaution apply to the man at the wheel of every motor vehicle as they do to the engineer with his hand on the throttle.

The Fifth National Careful Crossing Campaign of the Safety Section of the American Railway Association from June to September of this year has been given wide publicity. This campaign warrants continued effort. The railways are employing numerous means for the education of motorists but they must have more assistance from public authorities if any real progress is to be made along this line.

There has been a feeling in numerous quarters of late that the approaches to crossings on many railroads are not all that they should be. Generally speaking the approaches to grade crossings should be as nearly level as possible, which provision is not so important in the case of an overhead or undergrade bridge. The approaches should not limit traffic on the highway in respect to the number of vehicles or loads and the approach grades in level territory should be entirely different from those in mountainous territory. For instance, one large system generally works to an approach grade not exceeding six per cent in mountainous country, although this of course has to be exceeded in special cases, but in level country, on account of the generally favorable grades on the existing roads, it tries to work to a grade not exceeding four per cent.

The width of approaches in some states is determined by law. In Pennsylvania the law requires a minimum width of 24 ft. on new overhead or undergrade bridges. The importance of the highway should determine the width with some minimum; for instance, a width of 9 ft. should be provided for each line of motor vehicles, and where sidewalks are required a minimum width of 6 ft. is considered good practice. The surface on approaches to grade, overhead and undergrade highway crossings, should generally be paved with a bituminous macadam, except on state roads which are paved with concrete. Where the grade is unusually heavy, the specifications of the state highway departments calls for hillside brick on a concrete base.

Mr. Sweeney has for many years enjoyed the distinction of being one of the best known members of the Roadmasters' Association, and has had a prominent part in its affairs for a longer time than any other man who now occupies a responsible position in the organization. Mr. Sweeney became a member in 1892, served as second vice-president in 1902, first vice-president in 1909, and president in 1910. He has served for many years as supervisor of track on the Chicago & Eastern Illinois.

James Sweeney
Treasurer

Conclusions

The recommendations of the committee are:

1. At all important crossings, where train movements and highway traffic are heavy, the flashlight, which is actuated by approaching trains, should be adopted.

2. Where practicable these devices should be placed on a concrete ramp located in the center of the highway, similar to silent policemen. This will cause motor vehicles to slow down before approaching crossings and call their attention to the crossing.

3. On heavily traveled crossings in cities, towns and villages, where watchmen are necessary, a sign

to stop and go should be located on a concrete ramp in the center of the highway, operated by the watchman and not connected by a track circuit.

4. A committee of safety agents of different railroads in America and Canada should be appointed to adopt a standard railroad crossing sign, so that shape, coloring and lettering should be exactly the same.

5. The grade of approaches should not exceed that which prevails in the section of the country for highways of the class under consideration. The importance of the highway should determine the width and the surface should be a bituminous macadam on minimum grades and hillside brick with a concrete base on maximum grades.

APPENDIX

Crossings of the Coal Gas Tar Type

Installation No. 1—

Number of tracks.	Six.
Size of crossing.	64 ft. by 76 ft., 540½ sq. yd.
Material.	1,723 gal. of coal gas tar mixture.
	250 cu. yd. of 2-in. stone.
	10 cu. yd. of 3/8 in. stone.

Remarks: This crossing has a heavy switching and vehicular traffic. Labor consisted of changing out, loading and unloading 1,054 ft. of rail, 350 ties, applying tie plates, 620 ft. of 90-lb. guard rail, installing drain tile in inter-track spaces, etc. Repairs are handled by one man, requiring a few hours every six to eight weeks and cold patch and in ½-in. stone. Crossing is kept in good condition.

Installation No. 2—

Number of tracks.	Two.
Size of crossing.	30 ft. by 60 ft., 200 sq. yd.
Material.	400 gal. of coal gas tar mixture.
	35 cu. yd. of ¾-in. stone.

Remarks: Crossing has not been repaired since installed. Age at present date one year, seven months.

Installation No. 3—

Number of tracks.	Four.
Size of crossing.	278 sq. yd.
Material.	Coal gas tar mixture.
	Stone.
	Grits.

Remarks: Materials were mixed about one mile away from installation. Pavement has raveled along the rails and at joints, but is hard and firm at other places. Disintegration could probably be prevented by the use of metal flangeways. Work was done under traffic with 20 min. headway between passenger trains. Cost of stone was exceptionally high.

Crossings of the Oil Residue Type

Installation No. 1—

Number of tracks.	Six.
Size of crossing.	494 sq. yd.

Remarks: A bitumen of the oil residue type was used. Both rail and vehicular traffic are extremely heavy. Maintenance has cost 10.8 cents per sq. yd. since installation. Solid plank crossings previously installed at this location cost about $1 per sq. yd. per year for maintenance.

Installation No. 2—

Size of crossing.	32 ft. by 100 ft., 355.5 sq. yd.
Material.	163 tons stone ballast.
	45 tons ¾-in. stone.
	9 tons screenings.
	992 gal. bitumen.

Remarks: Track was cleaned out and 11 in. of stone ballast placed. Repaired twice since installation, first, one year later, and, second, two years later at cost of about 22 cents per sq. yd. and 23.5 cents per sq. yd. respectively.

Installation No. 3—

Size of crossing.	121 1/3 sq. yd.
Material.	Oil residue type of mixture.
	Stone.
	Grits.

Remarks: Crossing installed under traffic with passenger trains on 20 min. headway and freight trains in between. Condition good. Flangeways in excellent condition.

Crossings of Natural Rock Asphalt

Installation No. 1—

Number of tracks.	Two.
Size of crossing.	166 sq. yd.
Material.	Rock asphalt.
	Stone.

Remarks: No repairs after being in one year.

Installation No. 2—

Number of tracks.	Two.
Size of crossing.	22 ft. by 30 ft., 73.3 sq. yd.
Material.	15 tons of stone ballast.
	4 tons of ½-in. stone.
	5 tons of rock asphalt.

Remarks: Flangeway guards were used in this crossing. Highway traffic is heavy at this point.

Crossings of the Emulsified Asphalt Type.

Installation No. 1—

Number of tracks.	Six.
Size of crossing.	563.2 sq. yd.
Material.	1,494 gal. emulsified asphalt.
	77.5 tons ballast.
	27.4 tons ¾-in. stone.

Remarks: One of the busiest crossings on the railroad, as two streets cross on the railroad crossing. Material was installed on only three of the tracks. Costs were high because of space handicap, necessitating hand trucking material for a distance of 100 ft. or more. Crossing is standing up well.

Other Types of Crossings

Installation No. 1—

Material.	Coal gas tar used on one half and oil residue mixture on the other half of the crossing.
Traffic.	1,400 vehicles per 24 hr.

Remarks: Condition of crossing fair but required patching after one year.

Installation No. 2—

Material.	Asphalt.
Number of tracks.	Three.
Size of crossing.	50 ft. by 40 ft., 222 sq. yd.
Material.	1,000 gal. asphalt.
	105 yd. of 1½-in. stone.
	5 yd. 3/8-in. stone.

Remarks: No guard rail used. Repairs are made in a few hours by one man every 10 to 12 weeks.

Installation No. 3—

Material.	Asphalt.
Number of tracks.	Two.
Size of crossing.	50 ft. by 25 ft., 139 sq. yd.
Material.	600 gal. asphalt.
	60 yd. 1½-in stone.
	3 yd. 3/8-in. stone.

Remarks: No guard rail was used. Repairs have cost practically nothing after one year's installation.

Committee: A. E. Preble, supervisor, Penna., chairman; F. J. Meyers, assistant engineer, N. Y. O. & W.; A. A. Johnson, supervisor, N. Y. C.; D. C. McGregor, supervisor, B. & O.; E. E. Crowley, supervisor, D. & H.; F. W. Hillman, division engineer, C. & N. W.; and G. T. Anderson, general roadmaster, K. C. S.

Discussion

E. C. Buhrer (N. Y. C. lines) favored the use of a plank or some other form of guard along the outside of the head of the running rail to prevent the crumbling of bituminous material along the rail and in the discussion which followed it was brought out that some roads used a compound containing fibrous matter along the outside of the rail to avoid this condition while others obtained the same result by using a mixture richer in bitumen for this part of the crossing.

E. P. Safford (N. Y. C.) spoke of the importance of sealing the crossing against the passage of water to the subgrade by the use of a properly designed flangeway guard and of the elimination of joints in the

crossing. He also cited the use of a small concrete mixer mounted on a motor car for mixing the stone and bitumen for the repair of crossings, the outfit moving over the road and repairing all crossings needing attention before the beginning of winter.

Mr. Buhrer thought that one inch above the top of the rail was too high for a newly constructed crossing and stated that better results are obtained if the crossing is built up level with the top of the rail and raised later as the crossing is compacted. W. Van Gorder (C. C. C. & St. L.) stated that his practice in applying rock asphalt was to heat the material before applying it and then rolling it to the desired level, this method giving good results as to wear and freedom from breaking up.

Concerning the elimination of rail joints in crossings, J. P. Hurlihe (N. Y., N. H. & H.) cited his experience with five bituminous crossings which had been installed without flangeway guards and which had given considerable trouble. Last year flangeway guards were installed and the joints of the running rails in the crossing were welded together, the welding including the joint bars as well, with the result that no trouble has since been experienced with the crossings. J. P. Corcoran (C. & A.) said that welding the joints had been successful on the Alton and cited one long crossing in which four rails were welded together on each side of the track. The discussion developed that the practice of the Chicago & North Western is to weld rails together out of track and then to set them in to replace the rails in the crossings. The rails only are welded and the angle bars are applied afterwards as for an ordinary joint, as a matter of precaution in case of a weld failure.

The Collection and Use of Cost Data By Supervisory Officers

REPORT OF COMMITTEE

THE collection and use of cost data by supervisory officers is a problem which confronts all supervisors or roadmasters in the execution of their various duties in maintenance of way work. The application of unit costs to maintenance of way expenditures has been in the minds of maintenance officers for a number of years.

Efficiency in the operation and maintenance of railroads is promoted and encouraged largely by the comparison of one road with another and of various divisions and departments of the same system with each other. Various methods have come into general use in the mechanical and transportation departments on different systems where they have produced good results.

It is a difficult problem to devise a method of cost keeping which will serve the purpose of supervisory forces and at the same time be simple and intelligible to the foremen, on whom rests the responsibility for reporting charges accurately to the various accounts or headings. In many industries a cost system is considered satisfactory if it simply shows the cost of producing the several items of manufacture. Such a system must not only show costs as such but must show the possibility of their reduction.

In order to procure accurate costs it is necessary that a form of report be adopted which can be easily understood and filled out by the section or extra gang foremen under whose direct supervision most of the maintenance work is done. Few foremen are trained accountants and it is inadvisable to add to their many burdens by demanding complicated reports from them.

In order to determine maintenance of way costs, efforts have been put forth by various railways to gather data and establish yard-sticks to measure by, and each road has some such system of its own to further this end. However, as far as we are able to find, no general scheme has been developed. This committee has therefore endeavored to gather the data and prepare a report on relative or average costs of the following items, dealing with maintenance rather than construction. The table on the next page is the result of our efforts.

The figures shown are merely averages and will vary widely on different roads and on different divisions of the same system. The degree of refinement of the work and the density of traffic of the line on which the work is done will largely determine the cost but these figures will give us something to shoot

STATEMENT OF COST OF LAYING RAIL
Season_____

Class of Work _____ Division Supervisor_____

	Cost									Cost Per Ton								
	Labor			Work Train			Total			Labor			Work Train			Total		
1. Unloading & Distributing	Prod.	Non-Prod.	Total	Prod.	Non-Prod.	Total	Prod.	Non-Prod.	Total	Prod.	Non-Prod.	Total	Prod.	Non-Prod.	Total	Prod.	Non-Prod.	Total
A. Rail																		
B. Small Material																		
C. Total Unloading																		
2. Laying Rail																		
A. Preliminary Work																		
B. Laying Rail																		
C. Total Laying																		
3. Loading																		
A. Rail																		
B. Small Material																		
C. Total Loading																		
4. Total Cost of Rail Operations																		
Total Tons Rail Laid																		
Number Frogs and Switches Installed																		

Fig. 1—The Committee's Suggestion for a Statement of Cost of Laying Rail

at and will also afford a rough basis for comparison.

In order to arrive at these average costs, we must depend on the roadmaster or supervisor and the foreman for the detailed information necessary, and in order to get this information correctly and uniformly

DAILY REPORT OF TIE PLATES INSTALLED

Main Track

SECTION NO.____ DATE____

	Foremen Hours		Asst. Fore. Hours		Labor Hours		Work Train Hours	
	Prod.	Non-Prod.	Prod.	Non-Prod.	Prod.	Non-Prod.	Prod.	Non-Prod.
UNLOADING								
DISTRIB								
ADZING								
INSTALLING								

No. Tie Plates Installed____

No. Tie Plates Released____

Location____

Track No.____

Curve or Tangent____

NOTE Below:

PRODUCTIVE TIME - Show only hours actually worked on each operation.

NON-PRODUCTIVE TIME - This time includes all time paid for but not worked on each operation as above.

Fig. 2—The Committee's Suggestion for a Daily Report of Tie Plates Installed

we must have a form of report that will be comprehensive and yet not burdensome on them. We are submitting forms which, if filled out accurately, will cover the cost of rail laying, including tie plates and anti creepers. These reports should be made out at the close of each day's work and sent to the supervisor's office where charges should be drawn off and

DAILY REPORT OF ANTI-CREEPERS INSTALLED

Main Track.

SECTION NO.____ DATE____

	Foremen Hours		Asst. Fore. Hours		Labor Hours		Work Train Hours	
	Prod.	Non-Prod.	Prod.	Non-Prod.	Prod.	Non-Prod.	Prod.	Non-Prod.
UNLOADING								
DISTRIB								
INSTALLING								

No. Anti-Creepers Installed____

No. Anti-Creepers Released____

Location____

Track No.____

Curve or Tangent____

NOTE Below:

PRODUCTIVE TIME - Show only hours actually worked on each operation.

NON-PRODUCTIVE TIME - This time includes all time paid for but not worked on each operation as above.

Fig. 3—The Committee's Suggestion for a Daily Report of Anti-Creepers Installed

Labor Cost Only

Average cost to relay new trail, per track mile	$585.00
Average cost of loading old rail, per ton	0.90
Average cost of applying tie plates when laying new rail, per plate	0.01
Average cost of unloading rail, per ton	0.85
Average cost of applying a new switch and turnout when laying rail	48.00
Average cost of unloading ballast, per yard	0.09
Average cost of applying ballast, per yard	0.45
Average cost of cross tie renewals, per tie	0.35
Average cost of switch tie renewals, per tie	0.85

tabulated under the various accounts or headings. (See Figs. 1, 2 and 3.) Similar forms may be used for other classes of work.

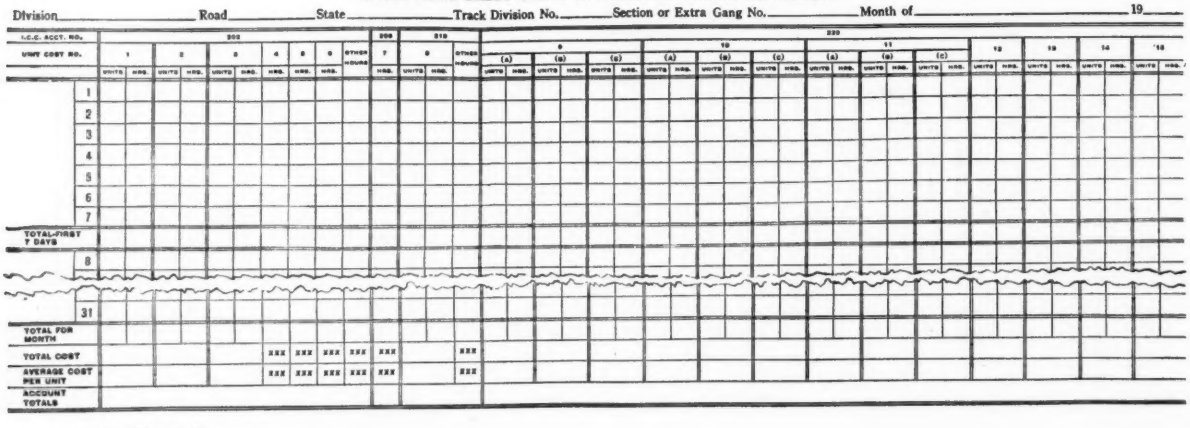
In making out these reports it will be noted that the labor is divided into productive and non-productive time. This should be taken into consideration for in many cases on single track territory much time is lost when it becomes necessary to close the track for trains. With productive time as a basis, comparisons can be made which will show just what items are costing more on one district than on another and from these comparisons steps can be taken to investigate and eliminate any practices which may be the cause of the higher costs. The number of lineal feet of rail laid in a day and the number of tie plates and anti creepers, frogs and switches installed are recorded on daily reports so that the unit costs can be ascertained easily.

The St. Louis-San Francisco has devised an elaborate system of accounting and collection of cost data, and when the clerical force is available, we recommend its use, attaching hereto some of the forms used. (See Figs. 4, 5, 6, 7 and 8.)

We have not been able to formulate a form of

CONDENSING SHEET—LABOR DISTRIBUTION—TRACK DEPARTMENT

Division____ Road____ State____ Track Division No.____ Section or Extra Gang No.____ Month of____ 19____



Actual Average Rate____

(A) Indicates Chatt or Gravel, (B) Slag or Rock, (C) Sand, Cinders or Earth.

Fig. 4—One Page of the Frisco's Condensing Sheet on Which the Data From the Foremen's Daily Reports Are Entered

TRACK FOREMAN'S DAILY REPORT OF LABOR DISTRIBUTION

Division_____ Track Division_____ Date Report Covers_____ (MONTH) (DATE) 19____

Location_____ From M. P._____ To M. P._____ Section or Extra Gang No._____

I. C. C. Acct.	Unit Cost No.	DESCRIPTION OF WORK	Trk. Loiter	Unit	NUMBER UNITS	HOURS NOT JOINT	HOURS JOINT	JOINT WITH (Name of Railroad or Industry)	MILE POST LOCATION FROM M. P.	FROM FEET	TO M. P.	TO FEET
202	1	Grassing Track and Cutting Sod Line		Track Feet								
"	2	Mowing and Burning Right of Way		"								
"	3	Dressing Ballast Shoulder		"								
"	4	Cleaning Ditches										
"	5	Patrolling Track										
"	6	General Yard Cleaning										
208	7	Bridges Trestles and Track Culverts										
218	8	Unloading Ballast		Cars								
220	9	Applying Ballast		Cu.Yd.								
"	10	Inserting Ties In Ballast		Each								
"	11	Lining and Surfacing Track out of Face In Ballast		Track Feet								
"	12	Inserting Switch Ties		L.Feet								
"	13	Laying Rail		Track Feet								
"	14	Spotting Track		Rail Length								
"	15	Applying Tie Plates		Each								
"	16	Tightening Bolts		Joints								
"	17	Repairing Frogs and Switches										
221	18	Repairing Right of Way Fences										
"	19	Repairing Cattle Guards and Wing Fences										
225	20	Repairing Public and Private Crossings and Signs										
227	21	Care of Station Grounds and Buildings										
248	22	Caring for Signals and Interlockers										
373	23	" " Switch Lamps outside Yards										
484	24	" " Signal Lamps										
378	25	" " Switch Lamps Inside Yards										
405	26	Watching Crossings										
		Describe below other roadway and track work not listed above.										
		NEW WORK AFE NO._____ Description_____										
		Grading										
		Drainage										
		Unloading_____ Ballast		Cars								
		Track Laying and Surfacing										
		Fences and Cattle Guards										
		Road Crossings										
		Placing Signs (Kind)		No.								
		Taking up or Moving Existing Tracks										
		Unloading Material for New Work										
		Picking up Material upon Completion of Job										
		TOTAL HOURS										

(Follow Instructions in Pocket Time Book, Form M. W. 23 Local.)

Fig. 5—The Foundation for the Frisco's System is the Foreman's Daily Report

report that will meet the requirements of various systems. Some railroads have an elaborate system of accounts and details, while others have only that which is required in a general way for Interstate Commerce Commission reports.

Every man in charge of the details of maintenance

SECTION AND EXTRA GANG LABOR—NUMBER OF UNITS, HOURS AND COSTS BY CLASSES OF WORK

Division_____ Month of_____ 19____

Item No.	DESCRIPTION OF WORK	UNITS, HOURS AND COSTS	CURRENT MONTH	LAST MONTH	SAME MONTH LAST YEAR	TOTAL THIS YEAR TO DATE
	Average Rate Per Hour					
1	Grassing Track and Cutting Sod Line	Track Feet				
		Hours				
		Total Cost				
		Average Cost				
2	Mowing and Burning Right of Way	Track Feet				
		Hours				
		Total Cost				
		Average Cost				
3	Dressing Ballast Shoulder	Track Feet				
		Hours				
		Total Cost				
		Average Cost				
8	Unloading Ballast	Cars				
		Hours				
		Total Cost				
		Average Cost				
		Cu. Yds.				

Fig. 6—A Portion of the Frisco's Form for the Monthly Division Report

SECTION AND EXTRA GANG LABOR Office of Chief Engineer.

NUMBER OF UNITS AND AVERAGE COST PER UNIT BY CLASSES OF WORK

Division_____ SYSTEM (EXCLUSIVE OF TEX. LINES) of APRIL 19 25

Item No.	DESCRIPTION OF WORK	UNITS AND UNIT COSTS	CURRENT MONTH	Man Hours	Percent of Total Hrs.		
	Average Rate per Hour		$ 0.1849				
1	Grassing Track and Cutting Sod Line	TRACK FEET	2,557,719	18,842	2.39%		
		COST	0.006				
2	Mowing and Burning Right of Way	TRACK FEET	222,620	1,650	0.19		
		COST	0.008				
3	Dressing Ballast Shoulder	TRACK FEET	914,589	25,856	3.32		
		COST	0.012				
4	Unloading Ballast	CARS	1,460	5,929	0.75		
		COST	1.766				
5	Applying Chat or Gravel Ballast	CU. YDS.	4,093	2,542	0.30		
		COST	0.173				
"	Applying Slag or Rock Ballast	CU. YDS.	694	347	0.04	0.50%	
		COST	0.199				
"	Applying Sand, Cinders or Earth	CU. YDS.	3,228	1,248	0.16		
		COST	0.175				
6	Inserting Ties in Chat or Gravel Ballast	EACH	27,855	28,141	3.58		
		COST	0.324				
"	Inserting Ties in Slag or Rock Ballast	EACH	14,799	11,417	1.46	9.69%	47.53%
		COST	0.324				
"	Inserting Ties in Sand, Cinders or Earth	EACH	48,403	28,971	3.66		
		COST	0.297				
7	Inserting Switch Ties	LINEAL FEET	44,933	7,258	0.92		
		COST	0.048				
8	Lining and Surfacing Track in Chat or Gravel Ballast	TRACK FEET	361,845	31,603	3.99		
		COST	0.060				
"	Lining and Surfacing Track in Slag or Rock Ballast	TRACK FEET	105,188	12,478	1.57	9.79%	
		COST	0.082				
"	Lining and Surfacing Track in Sand, Cinders or Earth	TRACK FEET	214,403	33,344	4.23		
		COST	0.049				
9	Laying Rail	TRACK FEET	100,509	11,588	1.46		
		COST	0.080				
10	Spotting Track	RAIL LENGTH	111,115	142,237	17.95		
		COST	0.021				
11	Applying Tie Plates	EACH	14,413	1,381	0.17		
		COST	0.041				
12	Tightening Bolts	JOINTS	136,345	12,347	1.56		
		COST	0.041				
13	Cleaning Ditches	HOURS		29,535	3.89		
14	Patrolling Track	"		35,122	4.43		
15	General Yard Cleaning	"		22,531	2.84		
16	Bridges Trestles and Track Culverts	"		2,360	0.30		
17	Repairing Frogs and Switches	"		14,899	1.84		
18	Repairing Right of Way Fences	"		15,111	1.91	19.29%	
19	Repairing Cattle Guards and Wing Fences	"		8,229	1.04		
20	Repairing Public and Private Crossings and Signs	"		17,443	2.20		
21	Care of Station Grounds and Buildings	"		15,189	1.91		
22	Caring for Signals and Interlockers	"		1,344	0.17		
23	Caring for Switch Lamps outside Switching Yards	"		16,722	2.11		32.47%
24	Caring for Switch Lamps Inside Switching Yards	"		8,050	1.01	10.14%	
25	Caring for Signal Lamps	"		6,414	0.81		
26	Watching Crossings	"		40,324	4.81		
	Miscellaneous Other Maintenance Labor Excl. Items 13 to 22 Incl.	HOURS		122,891	15.47		
	New Work	HOURS		40,324	5.18		
	Other Labor (Excl. Items 25-26 Inc)	"		19,465	2.46		
	Total Hours			792,509	100.0%		
	Total Cost			$200065.21			6-4-25

Fig. 7—A Typical Frisco Monthly System Summary

of way operation is compared with some other man in the same class of work by his higher officers. It is the man who produces the best results with the same number of man hours or amount of money who is worth more to his employer. It is by a comparison of costs as well as by the work that the best results are obtained.

Committee: E. P. Hawkins, division engineer, M. P., chairman; G. W. Koontz, division engineer, St. L. S. F. & T.; A. A. Cross, supervisor, N. Y. N. H. & H.; S. A. Bryan, roadmaster, S. A. L.; F. R. Rex, supervisor, Penna.; M. Donahoe, general roadmaster, C. & A.; J. Morgan, supervisor, C. of Ga.

Discussion

F. W. Easton (S. P.) and J. Sweeney (C. & E. I.) suggested that a daily distribution of time should show not only the time and cost for any kind of work, such as laying rail, but also the information for the various details of that work and the time and causes of delays to the gang from various causes. A discussion of the difficulties of securing this without adding to the foreman's duties or providing him with clerical help followed and L. B Allen (C. & O.) said this could only be done by the education of the foremen and that the Chesapeake & Ohio assigned special men to inaugurate the system with the idea that after the system was well established the extra clerical force in the field would not be necessary. H. R. Clarke (C., B. & Q.) said there were two angles to cost data: Its collection and its use, and in order that it would be of use to the supervisory officers it should reach them promptly as the work progresses and in such shape as not to need a great deal of analysis, since the roadmaster or supervisor has little time or office force for such work. On the Burlington cost accountants have been assigned to large A. F. E. jobs who make a check daily on unit costs for comparison with the estimates and are often able to show where corrective measures should be applied as the work goes on. Where the information is collected only after the job is finished it is a post-mortem instead of a cure.

G. J. Johnson (C. & O.), in commenting on the system in vogue on the Chesapeake & Ohio, stated that on some jobs it was sometimes impossible to make a complete cost study for any particular job for some time, but that monthly statements were sent to each supervisor, showing unit costs for each of his sections for the preceding months and that with these data he is able to study the causes of excessive costs. The system has been in use about a year and the results obtained have more than paid for its cost.

L. M. Denny (C., C., C. & St. L.) said the report was very good as far as it went but that he felt it was incomplete and his motion that it be received as information was carried.

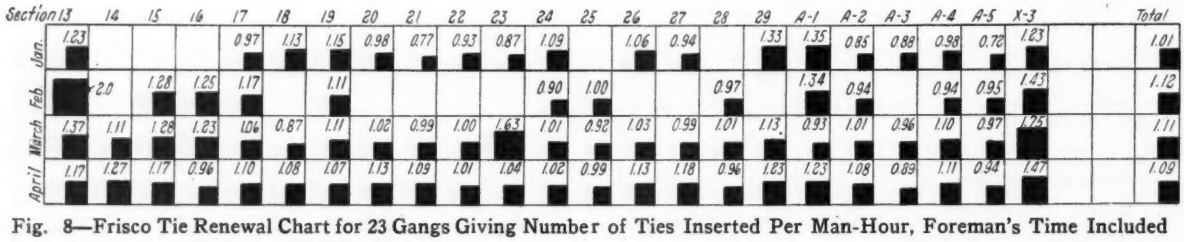


Fig. 8—Frisco Tie Renewal Chart for 23 Gangs Giving Number of Ties Inserted Per Man-Hour, Foreman's Time Included

The Re-arrangement of Track Work to Promote Uniform Forces Throughout the Year

REPORT OF COMMITTEE

WITH THE co-operation of a railroad management a uniform maintenance of way force the year round can be made a success on any railroad regardless of climate or location. The following items of work can be carried on throughout the winter: (1) Spotting and distributing of ties; (2) laying new rail and picking up old rail and scrap; (3) gaging track and applying tie plates; (4) tightening bolts; (5) tapping down spikes; (6) widening banks with cinders; (7) ditching, and (8) building fence. When the weather is extremely cold and a heavy snow storm is keeping a gang from doing anything else, there is sufficient work for it in keeping the switches, yards and interlocking plants open.

The ties should be spotted in the fall and a record made of the number needed between each two mile posts. As soon as the new ties are received they can be distributed with a work train and be ready for renewals in the spring. The track can be gaged in the winter and the application of tie plates can all be done. All bolts can be tightened and spikes tapped down during the winter, while banks can be widened with surplus cinders.

New rail should and can be laid in the winter, regardless of the presence of snow on the ground, as snow on the track is never deeper than the rail. Two men with brooms can go ahead and sweep the snow away from the rails. The chairman of this committee relaid the rail on 26 miles of track with new 100-lb. rail last winter and could have laid four times as much if he had been furnished the rail. On this work the section forces were doubled up and a work train and a rail loader used. The rail was unloaded from cars into the track, after which the men went back over the same territory and picked up the old rail and scrap. This force laid an average of 13,000 ft. of new rail in eight hours with 80 men. By doubling up section gangs in this manner there is no need to hire new men for the work. On the chairman's subdivision we have also repaired and built 15 miles of fence this winter and have also cleaned one-half mile of ditches, for there are many days during the winter when the ground is not frozen hard enough to prevent ditching.

By maintaining uniform forces the year round, all of the work mentioned above can be done in the win-

ter. As a result there is no need of hiring a bunch of inexperienced men in the spring for the regular forces can take care of the tie renewals, surfacing of the new rail, lining of track, the application of new ballast and the correction of the sod and stone lines; and also weed the track and mow the right-of-way. One man who has been on the force regularly is worth three new men in working on track. As the men who have been kept the year round are acquainted with the work, they are worth much more to the company. Most men who work the year

Work should be programmed by all means. The supervisor can arrange a schedule for the six months of winter and another for the summer, and the foremen can arrange their work accordingly, so that the same kind of work will be done over the division at the same time. Conditions are about the same over any supervisor's territory and with the exception of miscellaneous duties, work can be taken care of by program. Each section can be putting in ties at the same time, so that they can all surface their tracks about the same time. All sections doing about the same work at the same time makes for uniform appearance and riding condition.

Committee: J. Clark, supervisor, B. & O., chairman; C. W. Coil, roadmaster, N. P.; Oscar Suprenant, roadmaster, D. & H.; W. A. Clark, supervisor, P. & R.; W. E. Carter, supervisor, B. & L. E.; R. H. Smith, assistant superintendent, N. & W., and W. F. Nichols, supervisor, L. V.

The Importance of More Uniform Forces

By LEM ADAMS
Maintenance Assistant, President's Staff, Union Pacific, Omaha, Neb.

IT IS an axiom in industry that uniformity in volume of work and continuity in operations are essential to maximum efficiency, and as these decrease, cost increases. There is no condition that is more important to the trackman than a logical, seasonal outline of his work that will permit him to maintain a fairly uniform force allowance throughout the year. A few good, well trained men, will accomplish as much work as double the number of green men, and do it much better with less supervision.

Despite the opinion of some that track laborers need no special training, track work is a specialty, and trained men are required for efficient and economical upkeep of the section. We cannot expect to have such men if we practice the policy of laying them off anytime—and often on very short notice. These men naturally seek other work of a more stable nature, and what training they may have received is lost to the railroad. It costs money to train a man to usefulness in any job. Therefore, why should we throw away the fruits of our labors? What is more discouraging to the foreman than to have a good gang laid off on account of arbitrary force reduction and then later have to break in new men?

During the days when good track men were readily obtainable when we wanted them, we could afford to do all of our work when conditions seemed just right, or money was available, but that time is past, and we must now look toward a means of progressive plans to keep our maintenance forces economically employed the entire year. This, of course, leads to the consideration of "what work can be done in the winter months," in northern climates particularly, and still get value received. The A. R. E. A., through its Committee on Economics of Railway Labor, is now studying this phase of your problem.

The most important of the items proposed for winter attack is rail renewals. There are very few places in the United States, with the exception of a few days per month, where rail cannot be relaid economically in winter. On these days your men will be busy cleaning snow and ice to keep trains moving. Your section gangs can be bunched for winter rail work and thus avoid the necessity for handling it with extra gangs later on, and we all know that when a section foreman does any general improvement work on his own section, it will be done better than if done by forces that are not considerably interested in the future maintenance of that track.

During the winter men work with more vigor than during the heat of summer, thus securing a higher performance per man day. In case it is desired to increase forces to handle rail relaying, men are always plentiful at this season, and are glad to have warm quarters in case weather is too bad to work, and they are not needed for snow cleaning. Again, train service is less frequent after crops have been harvested and moved to market. Therefore, winter seems to be the ideal tme for rail relaying.

The next items of importance for the trackman's winter employment should be adzing in and gaging rail; tightening bolts, driving down spikes, repairing frogs and switches, applying rail anchors, and installing tie plates where none previously existed. These are largely "housekeeping" items that can ordinarily be postponed for more important work, with the result that they are often put off too long. In locations where snow is not too deep, right-of-way fences can be repaired during winter months. Winter is a good time for distributing ties by work train or by motor car, so that they will be where they are needed when renewals start in the spring.

With work of the kind just enumerated behind us, we are free to get at tie renewals as soon as the frost is out of the ground, and to pursue this work with vigor for three or four months, picking up low spots as we go along. Tie renewals usually cause dust, and with this work done before the summer tourist season begins, a great nuisance is abated. Following tie renewals, some weed cutting is necessary, even if mechanical means or chemical is generally used for weed destruction. Ballast repairs and renewals are next in order. Therefore, section forces would be available for the handling of that duty and all ballasting should be completed by October, leaving from a month to six weeks to get dressing and spotting in shape for winter.

You, as the official custodians of track, are more vitally concerned than any one else in the programming of your work, and while we realize that you are not all given a free rein in this matter, you can preach to your officers the doctrine of economies to be realized through uniform forces, and thus bring forth the day when your foremen can say to his applicant for section work: There is constructive work ahead for every day in the year, so long as he is faithful and loyal.

What a difference this would make in the quality

of the labor you would secure! With reasonable assurance of steady employment your gangs would always be up to allowance, and your turnover negligible. Then the question of a source for future section foremen would be solved, as you could pick a well trained man from almost any gang; while now you are wondering where the foremen of tomorrow will come from.

These are, of course, ideals, but they are the things we dream of and must work for; and there is no organization so adequately suited to accomplish this purpose as yours. Therefore, it is up to you to sell this idea to your officers and get it in force on your railroad at the earliest possible moment. And, let us hope that before another working season begins you will be able to have your work programmed in such a way that will permit you to know at all times just what the work ahead will consist of, and that you will be able to follow it through in a logical procession from the beginning to the end of the year.

Discussion of Committee Report and Mr. Adams' Paper on More Uniform Forces

E. P. Safford (N. Y. C.) said he realized that it would be impossible for the railroads to establish absolutely uniform forces throughout the entire year. Nevertheless, he felt that everything should be done to provide greater permanence of employment in track work. E. C. Buhrer (N. Y. C. lines), while favoring plans for more uniform forces, did not approve of the committee's suggestion of doubling up the section gangs to handle major operations. Even with uniform forces he felt that a proportion of the force should be organized in extra gangs. B. C. Dougherty (C., M. & St. P.) and several other speakers questioned the possibility of developing as high efficiency of track forces on the winter work as on summer work because of the heavier clothing it is necessary for men to wear and because of other obstacles of inclement weather.

P. J. McAndrews, while indorsing the spirit of the report, objected to the wording of the first paragraph as offering a conclusion which is warranted by circumstances, but on 75 per cent of the railroad mileage in the United States, he added, there is opportunity for a marked reform in the methods of employment in maintenance of way work. The forces could well be spread out over a much greater part of the year, and much more work could be done readily in winter than is now the case. He pointed out that there are many days in every winter when rail laying can be done in most parts of the United States. Greater uniformity of force within practical limits would readily effect a reduction of 40 per cent in the prevailing turnover in maintenance of way forces. As it is now, all of the railroads want the maximum possible number of men for six months of the year. W. A. Clark (Reading), endorsed Mr. Andrews' objection to the first paragraph and offered an amendment which would change the first paragraph to read as follows: "With the co-operation of a railroad management, a uniform maintenance of way force the year round can be made a success where weather conditions permit." This motion was carried.

E. E. Crowley (D. & H.), called attention to the fact that all winter months are not equally favorable for the handling of rail renewals. He said that the Delaware & Hudson had laid rails for the past two or three years during the month of January and February, but owing to the trouble with frost and snow it had been concluded to begin rail renewals in November with the idea of having the work completed by the first of the year.

Louis Yager (N. P.), said that the problem of obtaining more uniform employment of men in maintenance of way work was that of placing it on a practical basis. Some railroads have developed this plan with a high degree of success. Others could well put it into effect but have not done so because of force of habit. Some railroads have widely varying climatic conditions, permitting the shifting of forces from one portion of the line to another so as to carry on major operations in the seasons most favorable to each territory. He laid particular emphasis on the fact that it is not going to be possible to get better work done or do it more efficiently during the winter season than in the summer, but he felt that the advantages of more uniform employment in the maintenance of way department on other considerations will be found to outweigh the difficulties inherent in winter work. A. E. Preble (Penna.), heartily favored more uniform forces as a means of obtaining greater efficiency. In his opinion, one trained man can readily do the work of three green men who, under present conditions of employment, are drawn from the most undesirable classes of labor.

Program on Tuesday Evening

A SPECIAL feature of the convention program was a meeting on Tuesday evening, the chief part of which was an illustrated lecture by J. V. Neubert, engineer maintenance of way of the New York Central, Lines East of Buffalo, New York. Mr. Neubert opened his lecture with a brief introductory history of the beginning of the railroads, with the introduction of steam power in 1784, the first use of locomotives in South Wales in 1808 and the operation of the first locomotive in America on the Baltimore & Ohio in 1830.

The first slides shown offered an interesting comparison between railroading as it was conducted in the early days and as it is today. This comparison included locomotives, passenger stations and track construction, but was devoted largely to comparison between methods of conducting maintenance of way and construction work in the past and at present. Under this head may be mentioned grading equipment, including steam shovels, cars and spreaders and material-handling equipment, primarily the locomotive crane. Following this he presented a number of pictures of more recent developments in labor-saving equipment used in maintenance of way work, such as a double-boom crane for handling rail, the New York Central's ballast scarifier for removing weeds, motor cars, the Neafie oil sprayer, pneumatic tie tampers, etc. A number of slides showed the past and modern equipment for the handling of snow.

Timber preservation also received special attention with slides illustrating the seasoning, adzing and boring and preservative treatment of ties. In Mr. Neubert's opinion improved practices in the handling of ties offers one of the most fertile fields for economy in maintenance of way.

Mr. Neubert also touched on the opportunity for

economy in labor through the development of greater stabilization of employment. He illustrated this point by a chart showing the seasonal variation in the employment of labor over a period of years, which illustrated not only the fluctuation from year to year with annual variation in earnings, but also the far greater fluctuations between the winter and summer months, and pointed to the advantages of more uniform forces.

Another feature of this lecture was a discussion of European practices in track construction, illustrated by slides showing rails and rail fastenings, calling particular attention to the use of rail chairs having a large bearing area on the ties which are especially prepared by mechanical adzing of the ties before the chairs are applied. He also called attention to the marked economies effected in the use of materials. This, he said, was in sharp contrast to American practice. "Here, we save labor and waste material. In Europe, they waste labor in order to save material."

In closing, Mr. Neubert paid a tribute to the men in the ranks who have given their lives to service in the maintenance of way department. These men, no matter what their rank or position, could well be called "jewels of the wheels of transportation."

Placing the Track Department on a Business Basis

By C. A. MORSE
Chief Engineer, Chicago, Rock Island & Pacific

I HAVE often wondered how it happened that those who organized the track department on the railroads of the country 50 to 75 years ago could have had such wonderful foresight as to devise an organization that could not or would not be improved in all these years. I began railroad work on the Chicago, Burlington & Quincy in the spring of 1880. At that time a roadmaster had charge of from 100 to 175 miles of territory, depending on its importance, and a section foreman had approximately six miles of lines to look after. The foreman worked six or eight men in the summer and was cut down to one or two men in the winter. The roadmaster's territory was probably designed originally to be an engine district plus any short branch lines connecting with the main line within the limits of the engine district. The section foreman's territory was probably the result of the fact that the stations averaged about six miles apart.

If you will look over the organizations of the majority of our railroads today, you will find that the organization of the track department, up to and including the roadmaster is practically the same today as it was in 1880. At that time we were using from 47 lb. iron to 56 lb. steel rails. We had little or no ballast west of Chicago, except in a gravel country. We had small locomotives, small cars and comparatively few trains.

The section foreman surfaced his track from one end of the section to the other and inserted what new ties were needed each year. He mowed his right of way, ditched in the spring and fall and repaired his fences in the winter. Yet with the heavy rail and ballasted track, with tie plates, and anti-creepers, with the heavy locomotives and rolling stock, the high speed and increased number of trains today, we find the same organization of the roadmaster's forces today that was in force 50 years ago.

I have often wondered at the fact that two things on railroads have undergone no change in all these years; viz.: the 5½ in. by 9/16 in. track spike and the organization of the roadmaster's forces. The first railroad that I worked on was laid with 47 lb. iron rails and used 5½ in. by 9/16 in. track spikes, and as a rule we are using them today.

The Roadmaster Should Be An Organizer

On some roads they use the term "supervisor," for what on most roads is called a roadmaster. The definition of a supervisor is one who supervises, an overseer, and the fact that this term has been applied to men occupying the position of roadmaster would seem to indicate that their duties were those of an overseer. I think that the fact that this name has been applied shows the idea that has been in the minds of too many high officials, and explains why the roadmaster's organization has not been changed or improved in the last 50 years. Instead of the roadmaster being considered a supervisor, he should be considered an instructor, a planner, and an organizer. The supervisory duties are a side issue and not his principal duties.

It was in accord with these supervisory ideas that the practice developed of roadmasters riding back and forth over their divisions on passenger trains and throwing off "butterflies." A roadmaster has no business on a passenger train more than once a week, just often enough to see how the track rides under high speed trains.

The Roadmaster Should Have Clerical Help

Since the days when this organization was started, the hand car has been replaced by the motor car, the track lever by the track jack, and power ballast tampers have come into common use together with the track liner, the power mowing machine, disc weed cleaners and liquid weed killers. The ditching machinery, the spreader and the combined spreader-ditcher have done away with the large amount of hand ditching and hand spreading of former days. However, notwithstanding all of the mechanical appliances that have been brought into use, no change has been made in the organization of the forces that use them.

Twenty-five years ago, I was located on a 350-mile division of an important railroad and the clerical force in the superintendent's office consisted of a chief clerk, a stenographer, a transportation clerk, a maintenance of way clerk and an OS&D clerk. Today that same division superintendent's office has probably 15 or 20 clerks, and so it is in the general offices, and in other division offices. This force is required to furnish data called for by regulatory bodies and by operating officials, all of which is needed for economical and efficient operation. In the maintenance of way organization the supervisory officials have been increased for the same purpose, but this all stops when you get to the roadmaster. On many roads today, he is not furnished with a clerk. A portion of the information he should have in his office, tabulated so he could study it, passes around his office and goes into some higher official's office

and is tabulated there. Copies of the section foreman's reports go to the roadmaster, but with no clerk and with certain office work that he must do, and which he can only do evenings and Sundays, or by taking a day off from his duties out on the line, he has no time to tabulate these reports. Therefore, they are filed and he gets no benefit from them.

On the majority of the railroads of the country there should be a complete reorganization of the roadmaster's forces. The roadmaster should have office help enough so that he can spend the working hours on the road, not riding on passenger trains, but out with his foremen, getting to and from the points where they are working on a motor car. He should not plan on being home every night but should have an expense account and he should stay out on the road over night whenever it will save time. He could do this if he had someone in his office who could take care of correspondence and could keep him informed by wire of any special messages or instructions.

There is no roadmaster without a clerk but will agree that he could do more and better work on his division if he could substitute a competent clerk for two laborers. The pay of the two laborers would pay the salary of such a clerk. When the roadmaster gets in off the road, he should not be obliged to spend all of his evenings and Sundays at the office. With the proper organization, a roadmaster should be able to spend his evenings and Sundays, except in emergencies, with his family.

Now as to some details of what he should do, when out on the road with his foremen: President Beatty of the Canadian Pacific, addressing a group of employees of that railroad just after the close of the war, stated that "Every able bodied man was worth common laborers' wages up to his chin. Whatever he was worth more than this came out of his head." This applies to roadmasters and section foremen. Their individual value depends on the use of their heads, not their feet or their hands.

More Definite Planning is Needed

The greatest weakness in our track forces is the lack of definite planning of their work. They do all right when they are inserting ties, ballasting, repairing fences or some such work where they have a definite job to do on any particular day, but as we all know, the greater part of their time is occupied in doing odd jobs, and in keeping up the line and surface of the track. It is in connection with this class of work that some planning is necessary.

I never go out over the road without seeing not one but a dozen section gangs standing by the side of the track, where they have set off their motor car to let the train pass, and this in the middle of the forenoon or the middle of the afternoon. There is not one section foreman out of three who knows when he leaves the tool house in the morning where he is going or what he is going to do that day, except during tie insertion time or when he is doing some patch ballasting.

The roadmaster should go over each section with the foreman each Fall and plan the work other than line and surface that should be done the coming year. A list should be made of this work. This should be sent in to the officer to whom the roadmaster reports and should form the basis for the maintenance budget for the coming year.

The roadmaster should go over with each foreman the portion of this work that can be done in January and the foremen given a list of this work. This list should be posted in the tool house and each night if any of this work has been done that day it should be noted. When any item is completed a pencil line should be drawn through it. The roadmaster should go over the coming months work with each foreman prior to the beginning of the month. There will be spotting up to do from time to time but when that is done, the gang should get at once on to some of the work that was planned for the month.

Track Should Be Maintained Uniformly

In the case of ballasted track, which means most of the trackage of today, you can spot it up for two or three years, but it should be taken out of face once in four years and sometimes once in three years. However, based on an interval of four years between raises, work should be so planned as to take one-fourth of each section foreman's section out of face each year. This will reduce the spotting to a minimum and means that you are maintaining your track uniformly.

On long divisions or very heavy traffic divisions the roadmaster should have an assistant, as the roadmaster cannot get over the line often enough to carry out this program and at the same time see that the work planned has been done, and done properly. Quite a percentage of his foremen will acquire the habit of planning their work at the end of a year or two and eventually as the younger men step into these jobs, one of the requirements for a foreman will be that he can plan his work ahead.

One thing that is interfering more or less with a roadmaster's handling his work efficiently is the mania that has sprung up in the last few years for divisional meetings for all kinds of things. On some roads this is being worked overtime and roadmasters are taken away from their work as much as one day per week to attend these meetings. The idea behind these meetings is all right, but the object sought should be worked out so as not to interfere too much with a roadmaster's work.

One of the great handicaps to getting the track forces organized on an efficient working basis is the fact that for years the track department has been used as a "grab bag." If some official in the operating department wants to make a showing in some month, or if earnings drop off, they "grab" a lot of the maintenance of way allowance and it usually comes from the track. To carry out their orders it completely disorganizes the track work. If we could get the work of the track department so organized that we could get uniformity in our maintenance it would remove this temptation and would as a result reduce the cost of track maintenance to a minimum, and at the same time result in fairly uniform track condition.

Monthly Allowance for Maintenance is Wasteful

The monthly allowance method of handling maintenance of way expenditures, especially as regards the track department is a very extravagant way of handling this class of work. If the annual expenditures for maintenance of way other than operating expenses in connection with improvement work, were compared from year to year they would be found to vary but little as a whole, but compared by months they fluctuate very materially due to their being cut at different times for reasons before mentioned.

Additions and betterments authorities should carry with them the operation charges necessary to carry out

the work, and they should not be included in the ordinary maintenance allowance, or be in any way affected by the maintenance allowance. To do so delays improvement work, and results in material being delivered on the ground, and lying there sometimes for months, due to the maintenance allowance being too small to permit of work being done at the time the material is received.

The result is that not less than 10 per cent and in many cases as high as 25 per cent of this allowance is absolutely wasted, due to loss in connection with the reorganization of the forces several times during the year and due to a large allowance when business is heavy and a small allowance when business is light. My thought is that all material for ordinary maintenance including rail and fastenings should be charged out arbitrarily in equal amounts during the different months of the year, regardless of the business being done, and that the labor should be given as a yearly allowance, restricted possibly to a total for each three months of the year, but under no condition should it be made for a single month, as this invariably interferes with the economical handling of the work, and either restricts the work that should be done or causes a disorganization of the forces. In a conversation some years ago with a railroad official, who has since become the president of one of the most prosperous railroads in the country, we were discussing this question, and he stated that if he ever got where he could control the purse strings he would stop such foolishness. As he now occupies such a position and his road is one of the biggest dividend earners in the country, I judge that he has put his idea into effect.

It does not take much head work to see that the cost of doing track work where there are but ten trains to get out of the way of in a working day, will be much less than to attempt to do the same work at a time of the year when there are 20 trains to get out of the way of in a working day on the same piece of track.

The Handicap of a Uniform Wage Scale

Another handicap that track maintenance has been working under for years is that all men working on track work other than foremen or assistant foremen are classified as laborers and all the men in a gang are paid the same wages. The man with years of experience receives no greater pay than the foreign laborer who cannot understand what is said to him, or the green farm hand who knows nothing about the work.

In other departments there is a recognized difference in the earning power of men. In the bridge and building department we have first class carpenters who can do house carpentry, second class carpenters who can do rough house carpentry and bridge work and the handy man. In the water service department we have pipe men and laborers. In the shops we have machinists, helpers and also shop laborers. But in all these years, and notwithstanding the advent of the motor car, the tie tamper and other mechanical appliances and with split switches, complicated puzzle switches, movable crossing frogs, the application of anti-creepers and tie plates, we give no recognition to experience or skill, but classify all of the men in a track gang as common laborers.

We hear people along the railroad criticize the railroads for paying a higher rate to laborers than they pay in small towns and on the farm, but they do not recognize, and unfortunately our railroad officials seem to fail to recognize, that what we are paying for track men is a composite figure which is an average between what we should pay the experienced man and what we should pay for common labor. Such a practice is wrong, it stifles ambition by continually giving no reward for skill and experience. We today use seniority combined with skill as the rule for retaining men in service when forces are cut, but do not recognize skill and experience in wages while the men are employed.

Track Labor Should Be Classified

My own idea is that track forces should be divided into trackmen, trackmen's helpers and common laborers, and that where there is but one man on a section he should be a "trackman." When two men are employed the second should be rated as a "trackman's helper" and when three men are employed that the third should rate as a "common laborer." In large gangs they should be similarly divided and in the case of an extra gang it should be made up of approximately one-third of each class of men. Such a classification will permit paying more to the skilled man and it will awaken the ambition of each of the other classes to advancement. There is nothing that awakens ambition as much as the opportunity to earn more money.

My thought is that a classification of this kind should be put in gradually. In the spring of the year when gangs are being increased in size and when extra gangs are being put on, the additional men should be put on as common laborers and in the section gangs the new men should be added under this classification as men drop out. I would make five cents per hour difference between the wages of a common laborer and a trackman and make the "helper's" half-way between. This would mean that the trackmen would be raised 2½ cents per hour the "helper' would receive the present wages and the common laborer would get 2½ cents less than the present wages.

The result of such a classification would be increased interest in the work by all three classes and the foreman would have the "trackmen" as men whom he could put in charge of any special job where he had to or wanted to divide his gang. The increase in wages to the skilled man would not affect the railroad materially. No increases in trackmen's wages should be considered without some such classification. Unfortunately this has never been considered in wage hearings before the Labor Board, or in the present contracts with the brotherhood of maintenance of way men, but it should be taken up and something worked out along these lines.

Furnishing Section Houses a Discrimination

One of the things that has come down to many railroads from their pioneer days is the furnishing of quarters for section foremen at a nominal monthly rent. Such a rent was not so much out of line in the days when the salary of a section foreman was about $45 per month and when there were no towns where he could rent a place to live. Today with towns grown up along the railroad and with section foremen getting two and one-half times their former salaries, there is no reason why they should not pay a rental for living quarters that will pay interest, depreciation, repairs and taxes on the improvements used by them.

There are railroads in the West that furnish three and four-room section houses on a large lot, fenced

and with shade trees on the lot for a rental of $3 to $5 per month which will not any more than take care of the repairs, while similar quarters in the same town cannot be rented for less than from $15 to $25 per month. Again this works as a discrimination between foremen, as the man located at a point where there is no section house gets the same salary as the man that lives in a company house, and if he can rent a house, he has to pay the higher rental, while if there are no houses to be rented, he has to live in an old box car. The result is that men will not bid for a section that has no house and you cannot get as good foremen on these sections as you can on the other sections.

There is no reason for this condition to exist. It is simply one of those things that has come down from pioneer days and which has never been corrected. Probably not over 25 to 50 per cent of the sections are provided with section houses, but where they are located they should yield the railroad company a fair return on the investment and if they did this, they would be warranted in building houses for their section foremen at the many places where men are today housed in old box cars. Equal treatment to all is what we should plan to give, and there is no reason why the railroad should contribute house rent practically free to one man and make another rent a house or buy one in order to have a place for his family to live. It is not only unfair but it is decidedly unbusiness like.

What we should endeavor to do is to get the handling of the track department brought to business-like methods. I have given these ideas of mine to your association with the thought that possibly they might be well enough received that you would turn them over to some of your committee to see what they could work out of them.

Your association is made up of the men who are most familiar with the details of track work and who are most affected by the weakness of the present organization of the track department. All railroad officials have great respect for your association and the good work it has done and is doing every year. If there is any merit in the suggestions that I have made, and your association should present some plan for carrying them, or some other plan into effect, I feel that it would be given careful and serious consideration by the various railroads represented in the association. I believe that the failure to improve the track organization is a sin of omission and not a sin of commission and that the only reason that it has not been improved is that no association has gone into the matter and made recommendations for its improvement.

Why Care in the Selection of Cross-Ties?

By JOHN FOLEY,
Forester, Pennsylvania Railroad

STANDARD specifications for cross-ties have been developed by cooperative effort of representatives of the consumers, the producers, and the public. They have been approved and adopted by organizations of consumers and producers. They have been issued by consumers and orders under them have been accepted by producers. All this being the case, what more is to be done? Nothing, except to see that the ties received are standard ties. Who is in the best position to know whether or not standard ties are delivered? The man who uses them. As the men responsible for the selection of the materials that will give the best results, viz: the minimum expense to meet a given standard of service, have you members of the Roadmasters and Maintenance of Way Association assumed your full responsibility by seeing that suitable cross-ties have been supplied? Or have you been willing to take the ties given you, and make the best of them, whether they have been good, bad, or indifferent? This latter attitude on the part of the track man lets many unfit ties get into track, where they are not worth their cost.

On most railroads the executive officers of the maintenance of way department have determined the kinds and sizes of ties required for the various densities of traffic of their lines, like they have fixed the weights of rail required in your different lines. Without some such standards for cross-tie use, economical maintenance of track is impossible. Everybody knows that the insertion of a Size 3 tie in a storage track is as wasteful as the use of a Size 1 tie in a track carrying fast and frequent passenger trains or dense freight traffic: also that the use of untreated oak in the former track and of cedar in the latter track is likewise wasteful. Nobody does such things unless faulty procurement or distribution which they cannot change makes such misuse unavoidable.

The knowledge required to determine the proper tie for each class of track is wasted if the ties received for installation are not of the character required, and if corrective measures are not taken. That many distributed ties are not suitable for the use intended is well known. That most of them would be as required if more insistence were placed on getting them right is conceded by all familiar with the problems of tie procurement. Who should insist on good ties? The track man first, last, and all the time. It is money from his allotment which pays for the ties, and it is therefore his business to contend for his money's worth.

Cross-Ties Are the Foundation of the Track

The railroad track structure is founded on cross-ties, which not only support the rails, but also hold them to gage. Consequently it is most important that these foundation members be suitable in size, soundness, and strength. More care is required in selecting cross-ties now than formerly, for the simple reason that to a higher cost of purchase, transportation and insertion, is added in most cases the cost of preservative treatment. The annual saving sought in this additional investment is not obtainable from ties which are unfit to start with, and the expenditure to obtain it is wasted. The acceptance of undersize and unsound ties handicaps roadmasters and other supervisors of track in their efforts toward economical maintenance.

The premature renewal of a cross-tie is an unwarranted charge against the maintenance-of-way account. Negligence on the part of someone is responsible if the tie failed because it was not large enough, solid enough, or sound enough to render full service where it was used. Some of this responsibility rests on the roadmaster or track supervisor, if he has used without comment Size 3 ties only 5 in. thick or 6 in. wide. Had

he protested, he might have caused an inspector to be more careful thereafter or stopped a buyer from taking credit for purchasing ties at low cost, when actually he is getting only what he pays for. The track man who protests the receipt of decayed ties may have to his credit a reform in the inspector's work, or he may save the inspector from unjustified discredit when the practice prevails of letting ties stand after acceptance until needed or until supposedly seasoned, by which time they have decayed. Wherever track men see ties surrounded by water or weeds, before or after inspection, they should register their opposition to the receipt by them of ties subjected to such abuse. The track man who sees ties produced adjacent to his territory stand in solid stacks and sees them accepted by an inspector

A Tie Hacker in the Woods

who does not have them turned so as to "make a reasonably close examination of the top, bottom, sides, and ends of each tie," without criticism of such malpractice, has no right to complain if he gets sub-standard cross-ties.

The Quality of Cross-Ties is Improving

Not since trees were so plentiful throughout the country that ties of durable woods were to be had easily in any desired size, have cross-ties been of as good character as they are today. Proportionately fewer poor ties are produced than was the case a decade ago, although many thousands of them are marketed, and some railroads are getting most of them; not as what they are, but as good ties. The reason for this improvement lies in the progress which has been made in the standardization of cross-ties, especially within the past five years. Uniformity in specifications for cross-ties made little progress so long as individual engineers could exercise their vagaries and still meet their requirements from local supplies along their lines.

The abnormal conditions which developed during the world war provided the opportunity for attempting some reforms in the tie industry. The fundamental one was setting standards for cross-ties and their inspection. The need for such standards had long been apparent to those conversant with conditions in the industry. This need was brought home forcibly to many who ignored it before by the interchanges of ties which took place during 1918 and 1919. Those of you who suffered under the receipt of poor ties shipped by other railroads during that period might try to get some comfort out of the fact that some railroads learned from the ties they received that good ties were to be had.

Few railroads accept unfit ties deliberately and regularly. Some do so under the delusion that they need to, in order to save money or to secure their supply. The fact that accepting sub-standard ties raises prices and depresses production is a phase of the education of those responsible for the procurement of ties which is not within the province of this paper. Other railroads are woefully careless in connection with the inspection of cross-ties, and it is cure for this carelessness with which we are concerned. The first step is the adoption by all railroads of the standard specifications for cross-ties. This has been urged on each railroad by the president of the American Railroad Association in circular No. IV-45, July, 1926. If your railroad has not yet issued specifications in accordance with the standard, you are solicited to stress the importance of doing so. The standard is adaptable to conditions anywhere. You will find that it covers any kind of wood you wish to use and any size of tie you have need for. You need include in your own standard only the kinds and sizes you desire. Do not rest satisfied with the assertion of somebody that circumstances surrounding the conditions of supply, purchase, distribution, consumption, or use are peculiar in your particular case and justify departure from this standard. This cannot be because the standard is so comprehensive as to cover any conceivable condition.

Should Know the A. R. A. Standards

All those interested in track maintenance should familiarize themselves with the appended A. R. A. standards for cross-ties. They should ask for ties in accordance with these standards and promptly report the receipt of non-standard ties. If those who install cross-ties would drop the attitude that "a tie is a tie," and that they must use whatever ties are given because for some unexplained reason proper ties are not supplied, most of the present unsatisfactory situation would be eliminated. Many of the poor ties going into track get there because the roadmasters do not know what character of tie they are supposed to be supplied with, and because the trackmen do not know the specifications under which their ties are bought, and are therefore not in a position to determine whether the ties delivered are what they should receive. Only where the roadmaster or supervisor of track is so familiar with the standard specification for cross-ties that he can distinguish the various sizes at a glance and can recognize defects that are not permissible as he passes over his territory from day to day, is there the proper check on the acceptance of ties. Only division engineering officers have an opportunity to examine ties in detail as they are distributed before they go into track. Railroads which concentrate ties in large quantities for seasoning before treatment have the advantage of facilitating inspection by operating or other system executive officers.

Track Men Should Insist on Suitable Ties

Track supervisors and roadmasters know that a 100-lb. rail is standard for one line; 90-lb. for another; 85-lb. for another, etc. They would not use without question a non-standard section or weight of rail of less serviceability simply because it had been shipped to them. Similarly they should not use without question unsuitable ties in any situation. If the executive maintenance of way officers have not determined the kinds, sizes and sorts of ties suited to the various classes of tracks, the good judgment of the track men will make evident that someone has blundered when Size 2 ties are shipped where Size 4 ties are needed, when Size 5 ties are provided where Size 1 ties will serve satisfactorily, when decayed or excessively-split

ties are delivered as supposedly solid ones, or when non-durable woods are supplied without treatment for permanent tracks. The responsibility for results in the economical maintenance of tracks rests on those using the materials with which they work. Because it is fully realized that inferior track tools, motor cars, etc., are expensive, roadmasters rightfully resist the receipt of such equipment. If they will be equally as insistent that only suitable standard cross-ties are supplied, they will only be seeing that they get their money's worth.

Money Is Wasted When Poor Ties are Accepted

It is poor administration to organize and handle labor so as to obtain the most service at the least cost from track gangs, and then waste all the savings of economical management by losing money using material which renders short service. Each dollar lost through the purchase of poor ties is as large a dollar as one wasted through inefficiency in other directions. Because ties have to be used every year is no reason for growing callous to the fact that the dollar spent for them is as much of a charge on the maintenance of way department as the dollar spent for any other track objective. Ties which cost $0.25 per year of service are not as good as ties which cost $0.15 per year of service. Standard ties may cost slightly more than sub-standard ties to start with, but they are less expensive in the long run.

Where track men inspect for acceptance the ties which are purchased, they have no one to blame but themselves if they procure poor ties. Where the ties provided for their use are accepted by a regular inspection force, track men will be helped very much in contributing to the control of expenditures for ties if each tie received has on it marking of some kind to designate the standard size for which it was accepted, for without a mark to designate the standard size it is supposed to be, each tie received would have to be re-inspected by track men and the resulting tally compared with the shipping notice. With marked ties the check of inspection would not involve every tie. The roadmaster or supervisor of track could look at enough marked ties to satisfy himself whether or not the inspection was made in accordance with specifications. He could report whether any errors made were with certain sizes or whether the inspection was over-liberal or over-severe on all sizes.

Ties Should be Marked to Identify the Inspector

Experience has shown that where the marking to designate a standard size of cross-tie is supplemented by a mark to identify the inspector responsible for the acceptance of the tie, much better work is done. The inspector who knows that each tie he accepts carries on it a number or other mark that shows his responsibility for it is not as apt to be as reckless in his decisions as the inspector who is aware that there is no way to check his acceptance of individual ties. Insist on your cross-ties coming to you marked with their size and their inspector's designation, and you will help assure the receipt of standard ties.

Please do not be content with the mere adoption of the standard specification by your railroad. Simply ordering standard cross-ties will not insure the receipt of them. The standard specification must be supplemented by a standard inspection, which is a firm, but fair, enforcement of the requirements.

You may be told that nature provides trees grown in such a way that cross-ties meeting standard requirements cannot be had in quantity; but do not believe it. The study given to standard specifications covered all phases of the subject and you must rest assured that satisfactory ties can be procured wherever suitable trees and efficient manufacture are to be found.

You may be told that to conserve the forest you should use ties with small rotten spots in them; but do not believe that. The decayed area is very likely larger inside the tie than it shows on the surface and you are too intelligent to consider saving the loss of one rotten tie in the woods at the expense of one or more additional renewals in your track. Your aim is to conserve your expenditures as well as materials by using one sound tie that will last a long time, rather than two or more unsound ties in the same period.

You may be told that forest conservation calls on you to use small ties in order to avoid wasting the tops of trees; but do not believe it. Railroads have no responsibility for the complete utilization of every tree from which a manufacturer elects to cut one or more ties. You probably are embarrassed with an over-abundance of small ties now. You doubtless use the smaller sizes of ties wherever they are suitable because you would not increase your expenses by using large ties where they are not needed.

You may be told that more ties should be treated; and you can agree that there is room for improvement. However, no wood-consuming industry has done more to lessen the drain on the dwindling forests of America than has the transportation industry. The railroads are not only the pioneers in the field of wood preservation, but maintain leadership in this primary phase of intelligent wood utilization and conservaton by using over 90 per cent of all the wood given preservative treatment, of which cross-ties constitute about 70 per cent. Fifteen years ago, about 20 per cent of the cross-ties consumed were treated; now about 70 per cent are treated. The most ardent forest conservationist should be satisfied with this progress. In a comparatively few years, relatively few cross-ties will be installed untreated. Because nobody is seriously debating the use of treated ties in other than special situations, and nearly everybody is using some now, it may be said that the broad question of whether ties should be used with or without preservative treatment has been settled. Details in materials for and methods of treating probably will continue subject to debate, but those interested in the economics of ties have work to do which is necessary whether ties are used treated or untreated.

Since standard cross-ties have been established in the trade, ask for them, and insist on getting them. They represent the largest item in track material charges, and so are entitled to foremost consideration. It is hoped that the sketchy presentation of the subject to which you have listened will get for cross-ties the critical observation warranted by their importance in track.

Specification for Cross-Ties

Material

1. **Kinds of Wood*.** Before manufacturing ties, producers shall ascertain which of the following kinds of wood suitable for cross-ties will be accepted:

Ashes	Cypresses	Hickories	Poplars
Beech	Douglas fir	Larches	Redwood
Birches	Elms	Locusts	Sassafras
Catalpas	Firs (True)	Maples	Spruces
Cedars	Gums	Mulberries	Sycamores
Cherries	Hackberries	Oaks	Walnuts
Chestnut	Hemlocks	Pines	

Others will not be accepted unless specially ordered.

Physical Requirements

2. **General Quality.** Except as hereinafter provided, all ties shall be free from any defects that may impair their

*Each railway will specify only the kind or kinds of wood it desires to use.

strength or durability as cross-ties, such as decay, large splits, large shakes, large or numerous holes or knots, grain with slant greater than one in fifteen.

3. **Resistance to Wear.** When so ordered, ties from needle-leaved trees shall be of compact wood throughout the top fourth of the tie, where any inch of any radius from the pith shall have six or more rings of annual growth.

4. **Resistance to Decay.** Ties for use without preservative treatment shall not have sapwood wider than one-fourth the width of the top between (a) (see foot note) and (b) inches from the middle of the tie, and will be designated as heart ties. Those with more sapwood will be designated as "sap" ties.

Design

5. **Dimensions.**** Before manufacturing ties, producers shall ascertain which of the following lengths, shapes, or sizes will be accepted, and whether ties are to be hewed or sawed and in either case whether on the sides as well as on the top and the bottom.

6. Except as hereinafter provided, standard-gage railway ties shall be 8 ft., 8 ft. 6 in., or 9 ft. long; narrow-gage railway ties shall be 5 ft., 5 ft. 6 in., 6 ft., 6 ft. 6 in., or 7 ft. long.

7. Except as hereinafter provided, ties shall measure as follows throughout both sections between (a) inches and (b) inches from the middle of the tie:

Size	Sawed or hewed top, bottom, and side	Sawed or hewed top and bottom
0	5″ thick x 5″ wide on top†	5″ thick x 5″ wide on top
1	6″ thick x 6″ wide on top†	6″ thick x 6″ wide on top
2	6″ thick x 7″ wide on top	6″ thick x 7″ wide on top
3	6″ thick x 8″ wide on top	6″ thick x 8″ wide on top
4	7″ thick x 8″ wide on top	7″ thick x 7″ wide on top‡
5	7″ thick x 9″ wide on top	7″ thick x 8″ wide on top
6	7″ thick x 10″ wide on top	7″ thick x 9″ wide on top
		7″ thick x 10″ wide on top

Manufacture

9. Except as hereinafter provided, all ties shall be straight, well hewed or sawed, cut square at the ends, have bottom and top parallel, and have bark entirely removed.

Inspection

10. **Place.** Ties will be inspected at suitable and convenient places satisfactory to the railway, at points of shipment or at destination. Ties will be inspected at points other than the railway's property whenever in the judgment of the railway there is sufficient number to warrant it; but the shipper shall provide accommodations for the inspector, at the expense of the railway, while away from rail or steamer lines, and transport him from and to a railway station or steamer landing.

11. **Manner.** Inspectors will make a reasonably close examination of the top, bottom, sides, and ends of each tie. Each tie will be judged independently, without regard for the decisions on others in the same lot. Rafted or boomed ties too muddied for ready examination will be rejected. Ties handled by hoists will be turned over as inspected, at the expense of the producer.

12. **Decay.** The following decay will be allowed: in cedar and in cypress, "pipe or stump rot" and "peck," respectively, up to the limitation as to holes; in chestnut, "bark disease" up to ¼ in. deep. "Blue stain" is not decay and is permissible in any wood.

13. **Holes.** A large hole other than one caused by "pipe or stump rot" in cedar is one more than ½ in. in diameter and 3 in. deep within, or more than one-fourth the width of the surface on which it appears and 3 in. deep outside, the sections of the tie between (a) inches and (b) inches from its middle. A cedar tie with a pipe or stump rot hole more than 1½ in. in diameter and 15 in. deep will be rejected. Numerous holes are any number equaling a large hole in damaging effect. Such holes may be caused in manufacture or otherwise.

14. **Knots.** A large knot is one whose average diameter exceeds one-fourth the width of the surface on which it appears; but such a knot may be allowed if it occurs outside the sections of the tie between (a) inches and (b) inches from its middle. Numerous knots are any number equaling a large knot in damaging effect.

15. **Shake.** One which is not more than one-third the width of the tie will be allowed.

16. **Split.** One which is not over 10 in. long will be allowed, provided a satisfactory anti-splitting device has been properly applied.

17. **Manufacture.** A tie will be considered straight (1) when a straight line along the top from the middle of one end to the middle of the other end is entirely within the tie; and (2) when a straight line along a side from the middle of one end to the middle of the other end is everywhere more than 2 in. from the top and the bottom of the tie.

18. A tie is not well hewed or sawed when its surfaces are cut into with score-marks more than ½ in. deep or when its surfaces are not even.

19. The top and bottom of a tie will be considered parallel if any difference in the thicknesses at the sides or ends does not exceed ½ in.

20. **Dimensions.** The lengths, thicknesses, and widths specified will be considered met by ties 1 in. shorter, and ¼ in. thinner and narrower than the standard sizes. Ties over 1 in. but not over 2 in. more in thickness than the maximum ordered will be accepted as one size below the largest tie ordered. Those over 2 in. more in thickness; those over 3 in. more in width; or those over 2 in. more in length than the maximum ordered will be rejected. Ties will be sized up by their smaller ends and sized down by their larger ends. The dimensions of the tie will not be averaged.

21. All thicknesses and widths apply to the sections of the tie between (a) inches and (b) inches from the middle of the tie. All determinations of width will be made on the top of the tie, which is the narrower of the horizontal surfaces, or the one with narrower or no heartwood if both horizontal surfaces are of the same width.

Delivery

22. Ties delivered on the premises of a railway for inspection shall be stacked not less than 10 ft. from the nearest rail of any track at suitable and convenient places; but not at public crossings, nor where they will interfere with the view of trainman or of people approaching the railway. Ties shall be stacked in alternate layers of 2 and 7, the bottom layer to consist of 2 ties kept at least 6 in. above the ground. The next layer shall consist of 7 ties laid crosswise of the first layer. When the ties are rectangular, the two outside ties of the layers of seven and the layers of two shall be laid on their sides. The ties in layers of two shall be laid at the extreme ends of the ties in the layers of seven. No stack may be more than 12 layers high, and there shall be 5 ft. between stacks to facilitate inspection. Ties which have stood on their ends on the ground will be rejected.

23. Each stack shall have fastened to it a tag on which is written the owner's name and address, the date when stacked, and the number of ties of each kind of wood in the stack.

24. All ties are at the owner's risk until accepted. All rejected ties shall be removed within one month after inspection.

25. Ties shall be stacked as grouped below. Only the kinds of wood named in a group may be stacked together.

26. Class U—Ties Which May Be Used Untreated:

Group Ua
"Heart" black locust
"Heart" white oaks
"Heart" black walnut

Group Ub
"Heart" Douglas fir
"Heart" pines
"Heart" larches

Group Uc
"Heart" cedars
"Heart" cypresses
"Heart" red wood

Group Ud
"Heart" catalpas
"Heart" chestnut
"Heart" sassafras
"Heart" red mulberry

27. Class T—Ties Which Should Be Treated:

Group Ta
Ashes
Hickories
"Sap" black locust
Honey locust
Red oaks
"Sap" white oaks
"Sap" black walnut

Group Tc
Beech
Birches
Cherries
Gums
Hard maples

Group Tb
"Sap" cedars
"Sap" cypresses
"Sap" Douglas fir
Firs (True)
Hemlocks
"Sap" larches
"Sap" pines
"Sap" redwood
Spruces

**Each railway will specify only the length or lengths, shape or shapes, and size or sizes it desires to use; but each railway will use the standard designation for whatever size of tie it specifies. For example, a railway desiring 6 in. by 8 in. ties only will designate them as Size 3; a railway desiring 7 in. by 9 in. ties only will designate them as Size 5. A railway shall not, for instance, designate 6 in. by 8 in. ties as Size 1 and 6 in. by 6 in. as Size 2 or 7 in. by 9 in. ties as Size 1 and 7 in. by 8 in. as Size 2.

†None accepted in standard-gauge railway ties.

‡Railways which specify both 6 in. by 8 in. and 7 in. by 7 in. ties manufactured on top and bottom only and which desire to separate the 6 in. from the 7 in. ties will designate the 7 in. by 7 in. as Size 3A.

(a) 20 in. for standard-gauge railway ties.
15 in. for narrow-gauge railway ties.
(b) 40 in. for standard-gauge railway ties.
25 in. for narrow-gauge railway ties.

Group Td

"Sap" catalpas
"Sap" chestnut
Elms
Hackberries
Soft maples
"Sap" mulberries
Poplars
"Sap" sassafras
Sycamores
White walnut

Shipment

28. Ties forwarded in cars or vessels shall be separated therein according to the above groups, and also according to the above sizes if inspected before loading, or as may be stipulated in the contract or order for them.

Specification for Switch-Ties

Material

1. **Kinds of Wood.*** Before manufacturing ties, producers shall ascertain which of the following kinds of wood suitable for switch ties will be accepted:

Ashes	Chestnut	Gums	Oaks
Beech	Cypresses	Hemlocks	Pines
Birches	Douglas fir	Larches	Redwood
Cedars	Elms	Locusts	Spruces
Cherries	Firs (True)	Maples	Walnuts

Others will not be accepted unless specially ordered.

Physical Requirements

2. Same as for cross-ties.
3. Same as for cross-ties.
4. **Resistance to Decay.** Ties for use without preservative treatment shall not have sapwood wider than one-fourth the width of the top between 12 in. from each end of the tie, and will be designated as "heart" ties. Those with more sapwood will be designated as "sap" ties.

Design

5. **Dimensions.**** Before manufacturing ties, producers shall ascertain what sizes will be accepted and whether ties are to be hewed or sawed and in either case whether on the sides as well as on the top and the bottom.
6. Except as hereinafter provided, all ties shall be either 5, 6 or 7 in. thick as ordered.
7. Except as hereinafter provided, ties sawed or hewed on top, bottom and sides shall be not less than either 6, 7, 8 or 9 in. wide on top throughout the section between 12 in. from each end of the tie, as ordered; ties sawed or hewed on top and bottom only shall be not less than either 5, 6 or 7 in. wide on top throughout the section between 12 in. from each end of the tie, as ordered.
8. Each tie shall be of a length specified below:
(Insert complete bill of material here).

Manufacture

9. Same as for cross-ties.

Inspection

10 to 19 (inclusive). Same as for cross-ties.
20. **Dimensions.** The lengths, thickness and widths specified will be considered met by ties 1 in. shorter and ¼ in. thinner and narrower than the standard sizes. Ties over 1 in. more in thickness, over 3 in. more in width, or over 2 in. more in length than the maximum ordered will be rejected. The dimensions of the tie will not be averaged.
21. All thicknesses and widths apply to the section of the tie between 12 in. from each end of the tie. All determinations of width will be made on the top of the tie, which is the narrower of the horizontal surfaces, or the one with narrower or no heartwood if both horizontal surfaces are of the same width.

Delivery

2. Ties delivered on the premises of a railway for inspection shall be stacked not less than 10 ft. from the nearest rail of any track at suitable and convenient places; but not at public crossings, nor where they will interfere with the view of trainmen or of people approaching the railway. Ties shall be stacked at least 6 in. above the ground. No ties shall be unsupported for more than 10 ft. of its length. Each layer of ties and the ties in each layer shall be not less than 1 in. apart. Any stacking strips used shall not be over 4 in. wide. If rectangular ties are used to separate the layers, such strip ties shall be laid on their sides and the two outside ties as near as possible to the extreme ends of the ties. No ties shall be permitted to overhang more than 2 ft. No stack of ties shall be wider than 10 ft.
23 and 24. Same as for cross-ties.

*Each railway will specify only the kind or kinds or wood it desires to use.
**Each railway will specify only the shape or shapes and size or sizes it desires to use.

25. Ties shall be stacked as grouped below. Only the kinds of wood named in a group may be stacked together.
26. Class U. Ties which may be used untreated:

Group Ua

"Heart" black locust
"Heart" white oaks
"Heart" black walnut

Group Uc

"Heart" cedars
"Heart" cypresses
"Heart" redwood

Group Ub

"Heart" Douglas fir
"Heart" pines
"Heart" larches

Group Ud

"Heart" chestnut

27. Class T. Ties which should be treated.

Group Ta

Ashes
"Sap" black locust
Honey locust
Red oaks
"Sap" white oaks
"Sap" black walnut

Group Tc

Beech
Cherries
Gums
Hard maples

Group Tb

"Sap" cedars
"Sap" cypresses
"Sap" Douglas fir
Firs (True)
Hemlocks
"Sap" larches
"Sap" pines
"Sap" redwood
Spruces

Group Td

"Sap" chestnut
Elms
Soft maples
White walnut

Shipment

28. Same as for cross-ties.

Discussion

H. R. Clarke (C., B. & Q.), emphasized the importance of the message of this paper because of the enormous amount of money involved in the purchase of cross ties by the railroads. In his opinion, it should not be difficult for the roadmasters to check the ties furnished them because most roads have designated certain grades for use on certain divisions or portions of their lines and he urged roadmasters and supervisors to take pains to see that ties furnished them conform to specifications. The first responsibility of the roadmaster relates to the setting up of the particular grade or class of ties to be used on given lines and if in his opinion the standard established by the management is not correct he should not hesitate to state his objections. Others stated that the railroads are giving increased attention to the cross tie problem and that as a result the quality of ties is improving as the railroads are adhering more strictly to specifications. There is, however, room for improvement as there is still a wide difference in the extent to which specifications are observed in the acceptance of ties by various railroads. With ties representing the largest single item in maintenance of way expenditures, it is highly important that the roadmaster gives strict attention to the quality of ties furnished him.

In answer to a question as to the readiness with which tie producers can supply ties of different grades, Mr. Foley stated that there should be no difficulty in obtaining a supply of whatever sizes of ties are desired, the normal production of the various grades being approximately 30 per cent of Grade 3, 20 per cent each of Grades 2, 4 and 5, and about 10 per cent of Grade 1. In answer to a question from F. W. Easton (S. P.), as to the relative quality of timber to be had in large and small ties of Douglas fir, he stated that the ties are usually cut from trees which are normally of large diameter, and there should therefore be no difference whatever, although there might be some difference in the case of ties cut from small trees.

In reply to a question as to whether ties should be cut in the winter, when the sap is down, or in the summer, Mr. Foley stated that the question of sap was immaterial but that conditions in the woods were more favorable to decay in freshly cut ties in the summer than they were in the winter.

T. F. Donahoe (B. & O.), inquired as to the practicability of separating ties so as to insure the delivery of the largest and strongest ties to tracks with

heavy curvatures or which would otherwise receive especially severe service. Mr. Foley replied that railroads should endeavor to allot ties by divisions so as to take into account difference in density of traffic, curvature and other conditions affecting the service life of the ties from the standpoint of wear.

Track Joints and Their Maintenance

REPORT OF COMMITTEE

THE purpose of a track joint is to hold the ends of two adjoining rails together and in line and surface. To do this when there is no load upon the rails is of course a simple matter, but when the rails are loaded with a passing train, the requirements imposed upon the joints are not so simple. Take the case of a modern locomotive with wheel loads of between 30,000 and 35,000 lb., passing over the track and the burden placed upon the rail joint is of great consequence.

Unfortunately many people, and this applies particularly to the vast majority of would-be inventors of rail joints, have the idea that all that is required of a rail joint is to hold the load up. This, however, is far from being the case, for the laws of motion, as we find in the study of physics show "that for a body at rest to remain at rest it must either have no force acting upon it, or it must have equal and opposite forces acting upon it." Therefore, if our railway track rails, with their joints, are to stay in place, for every wheel load bearing downward upon them, there must be an equal tie support bearing upward against them. This tie support is just as much a force as the weight of the locomotive or car on top of the rail, and it acts in the opposite direction from the wheel load action.

The more flexible the rails the fewer ties there will be helping to hold up the load, consequently a greater force will be exerted by each tie.

Figure 1 is prepared with arrows above the rail representing the wheel loads of a locomotive acting downward on the rail and arrows below the rail representing the forces, or loads of the ties acting upward on the rail. Figure 2 is the same chart turned upside down to make it easier to realize that the forces of the ties' resistance constitute a load on the rail just the same in amount, but acting in the opposite direction from the load of the wheels.

This shows that with the locomotive wheels spaced as indicated in the figures the forces of four ties are acting upon the joint between the opposing forces, or supports, and consequently exerting as much force upward on the joint as is exerted downward by the wheel load when directly over the joint, and with perhaps greater lever arms. This should make it clear that the upward force acting upon a rail joint, due to the ties, is as great if not greater than the downward force of the wheel load on the joint.

The Design of a Joint

Because of the forces acting upon the joint as described above, it is necessary to make an efficient rail joint, that it have sufficient strength in both the top and bottom parts of the joint to prevent breaking, due to the stresses in either direction. The joint must also have sufficient bearing on both the underside of the head of the rail and the upper side of the base of the rail to transmit the stresses properly between the rail and the joints without undue wear.

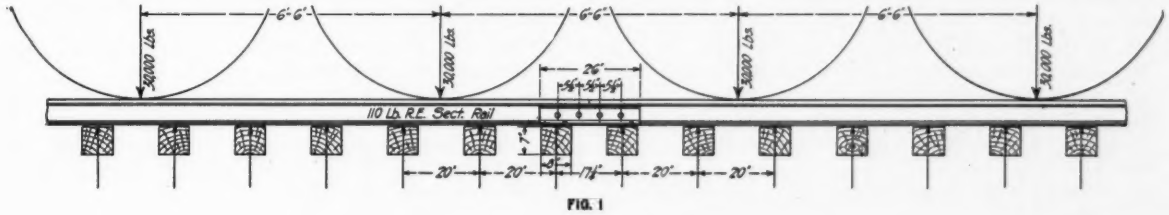


FIG. 1

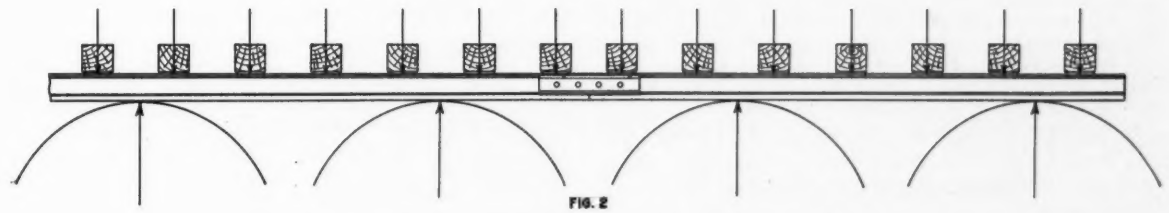


FIG. 2

If the joint bars are made to fit on the top and bottom *of the base* of the rail, with little or no bearing against the head of the rail the entire load on one rail must be transmitted to the next rail through the bases of the rails only. This applies to the upward acting forces the same as it does to the downward acting forces, and represents a complete change in the location of the neutral axis of the supporting members through the joint from where it exists in the rail away from the joint. Such joints are quite likely to result in many base failures of the rails, because the rails are not designed to handle the load in such a manner.

Joints which fit between the head and the base of the rail should be so made as to leave enough clearance between the joint bar and the web of the rail to provide for taking up the wear of the contact faces by tightening up the bolts, thus drawing the joints into proper contact again. Joint bars should be so designed that they will keep the tops, or faces of adjoining rails as near the same level as possible.

The use of any type of joint which has a base

plate or a supporting section which projects underneath the base of the rail, brings all the difference in the height of the two adjoining rails to the top, resulting in a tendency for the top of the higher rail to flow over onto the lower rail, or into the opening between the rails and thus become the cause of a chipped or battered end rail. Also, the joints which have a supporting base are generally used without tie plates, on the mistaken idea that such base plates of the joints take the place of tie plates.

The object of a tie plate is to protect the tie from being cut by the rail, and to be effective, the tie plate should remain in constant contact with the tie without any movement, for it is the movement which produces the cutting. For example, a file drawn across a piece of metal with only a small pressure will cut away the metal, while the same file if held still will bear probably a thousand times the load and cause no abrasion or cutting away of the support. The base plate of a joint, to be of any value to the joint, must be attached to the rail and move when the rail moves; to be a tie plate it would have to be free from the rail and remain with the tie without movement. Obviously it cannot be both at the same time.

The use of a joint which fits between the head and the base of the rail only and does not have any connecting portion under the rail, results in lining up the two rails on the top line of the joint bar, and only the difference in the thickness, or depth, of the rail heads comes to the top, thus making much less difference in the level of the tops of the rails.

The most efficient rail joint would seem to be one which:

1. Presents a good bearing surface to the underside of the head, and to the upper side of the base of the rail.
2. Has sufficient clearance from the web of the rail to permit the continued fit of the joint, in the fishing space of the rail, until a considerable amount of wear has taken place.
3. Has sufficient metal properly distributed above and below the neutral axis to take care of the forces acting upward as well as of those acting downward.
4. Produces the greatest strength in proportion to the amount of metal used.

The Length of Track Joints

In addition to the design of the rail joint, there is a question as to the most effective length of the joint and the number of bolts which will best carry the forces acting upon it.

The study of the rail and joint and of the forces acting upon them, as shown in Fig. 1, indicates that a joint long enough to cover three ties, with the ties so spaced that one of them is directly under the rail ends, increases the number of ties which are bearing the load directly with a consequent decrease in the tie forces acting against the rail at each tie. It also indicates a better proportioning of lever arms, but an analysis of the forces and lever arms, etc., of various arrangements of ties at joints would be too long a problem for consideration here. Experience gained from the actual use of joint bars long enough to span three ties and fastened with six bolts, indicates that they give results superior to the shorter joints fastened with four bolts, but whether they have sufficient advantage over the shorter bars to justify their greater cost, is not proven definitely.

As between a four bolt joint with ties spaced to a uniformly suspended joint, and a four bolt joint laid "hit or miss," a long and detailed study of lever arms and bearing points of the forces acting would have to be made to determine their relative merit, and even then it is doubtful if a definite decision could be reached without keeping careful cost records of installation and maintenance throughout the life of the rail and the joints in track.

A study throughout the life of the rail, of the the maintenance costs and the length of the life of rail under conditions as nearly identical as possible, except with different length joints, and of spaced ties, and of "hit or miss" laying of rail would be required to reach a decision as to the superior length of joints and manner of laying.

It is more than probable that a rail joint long enough to bear upon three ties, if the ties are spaced, is the better joint for use where rail is laid "hit or miss," as the longer joints are more certain to provide a good support for the rail ends, no matter where they may be with reference to the ties.

Experience with "hit or miss" laid rail is also indicating that joints can be maintained better by depending upon rail anchors to prevent the rail from creeping, and the eliminating of slot spiking of the joints. The slot spiking of the joints results in more or less, usually more, damage to the joint ties with consequent greater difficulty in joint maintenance. It is also good practice to provide for the wave motion of the rails to take place without disturbing the ties by leaving the spikes from 1/16 in. to 1/8 in. above the base of the rail.

Ties of uniform size, and of as near an average of all the ties used, should be selected for use as joint ties. If rail anchors are used opposite the joints, care should be taken to so place the tie plates that the anchors will not make contact with the plates, as rail anchors bearing against any tie plate throw the anchorage against the spike and produce all of the bad effects of slot spiking.

The Kind of Bolts and Springs

Following the selection of a type of joint comes the question of the kind of bolts and kind of spring washers or spring plates, if either are to be used.

Prior to 1912 loose bolts in rail joints were a common occurrence and called for a large amount of maintenance work to keep them tight. The idea was then quite generally held that nut locks were necessary on track bolts to prevent the nuts from backing off, or unscrewing. From an experiment made for another purpose it was discovered that most loose joints were due to the stretch and wear of the low carbon steel or iron bolts then generally used, and that the nuts on track bolts very rarely backed up, or unscrewed.

Following the discovery of the causes of loose joints, the alloy steel bolts were offered for track use, followed soon after by heat-treated high carbon steel bolts. Prior to the introduction of these high strength bolts it was impossible to bolt up a joint too tightly because the bolts would stretch before that condition was reached.

Joints Should Not Be Bolted Too Tightly

The much greater strength of the improved bolts has resulted in many rail joints being bolted up so tightly that the rail cannot slip through them to take care of the expansion and contraction of the steel due to changes in temperature. This condition results in kinky track in hot weather and occasionally in the shearing off of the two bolts in one end of a joint, here and there, in severely cold weather. On this account it is important that some form of spring washer or spring plate be used on joint bolts. Some

roads are reporting good success with each type of springs but it is possible to get joints bolted too tightly, even where springs are used.

Tests and experiments are under way to determine how tightly rail joints should be bolted and how to keep them at the desired tension after they are installed. It is quite generally conceded that heat-treated high carbon steel bolts with rolled threads should be used for rail joints and that some form of spring is desirable to maintain uniform pressure on the joints.

The Installation of Joints

An important factor in the efficiency of rail joints and in the cost of their maintenance is the manner of their application to the rails and the proper laying of the rails. The expansion and contraction of steel rails due to changes of temperature are very positive phenomena of nature and cannot be prevented or abolished. Consequently when laying rails the temperature of the rail itself should be determined at frequent intervals and the proper amount of space to take care of all expansion which may occur should be provided by use of spacing shims.

It is usually necessary to remove the shims before the joints are fully bolted up. However, the dipping of the shim in heavy oil or graphite paint before its use will usually facilitate its removal. Care must be taken to remove all expansion shims before leaving the rail-laying job. The rails should be anchored at once to preserve the expansion space provided for each rail, instead of permitting it to bunch up, resulting in tight joints at some places and wide spaces at others.

The joint bars should be clean and should be given a coat of oil all over and preferably a coating of graphite on the bearing faces. The oiling of the underside of the head and the upper side of the base of the rail, for the length of the joint bars, is also good practice. The joints should then be applied and bolted up as tightly as they can be without making them so tight as to prevent the slip of the rails due to expansion and contraction.

In order to insure the rails lining up correctly, that is to avoid lipped joints, the two bolts nearest to the rail ends should be tightened a little ahead of the remaining bolts.

If the bolts farthest from the rail ends are tightened first it results in the ends of the joint bars being bowed in somewhat and clamped into the fishing space of the rails. This occasionally results in the bars being prevented from slipping at the ends and leaves their centers bowed outward with consequent failure to line up the rail ends properly.

On rail-laying jobs the nuts on track bolts should be run up by power-driven wrenches, and the final tightening should be done with a hand wrench not over 36 in. in length, except where a wrench is used which is equipped with an indicator device which shows the tension on the bolt at every stage of the tightening up of the nut. Such a wrench has recently been invented and it should prove of great benefit in the proper application and maintenance of rail joints.

The Maintenance of Joints

The maintenance of joints, if restricted to the position of the joint bars only, would be a short story, but maintenance of joints is usually understood as embracing the fit and condition of the joint bars, the condition and tightness of the bolts, the condition of the rail ends and the line and surface of the track at and near the joint.

The maintenance of the joint bars should consist in seeing that all cracked or broken joints are replaced promptly, keeping the joints bolted tightly enough to transmit the stresses properly from each rail to the other and making sure that the joints are not bolted too tightly to permit of the slip of the rail to take care of the expansion or contraction of the rails due to changes in temperature. This may require the loosening of the bolts on some joints that are "frozen" (that is, clamped too tightly to allow of slip), and sometimes prying or jarring them loose from the rail, then to tighten them again to the proper extent, the replacement of all defective or worn bolts and the tightening of any bolts which may be found loose.

Track men should not get the idea that every bolt must necessarily be tightened some when going over their track tightening bolts. Some bolts may be tight enough. Care should be taken to avoid the use of wrenches which are too long, as extra long wrenches will result in some joints being bolted too tightly, where high strength bolts are used.

The stretching of a bolt is a damage to the bolt, for it has less strength after it begins to stretch than it had before.

The condition of the rail ends is very important, and foremen should be instructed to have any metal which rolls out from the end of the rail sawed or chipped off to prevent its acting as a wedge when the rails run together, and causing a chip to be split off the end of the adjoining rail. When rail ends become battered or chipped to such an extent as to cause pounding of the joint, they should be repaired by welding. Section foremen should be instructed to keep watch of joints which are battered or chipped enough to cause extra work to be done to keep them surfaced up, and to notify the roadmaster at regular intervals of the location of joints needing the attention of the welding gang.

All joints should be watched for alinement and if found to be out of line to a greater extent in hot weather than in cool weather, steps should be taken to determine if the rails are laid too tightly or whether the joints are bolted so tightly that the rails cannot slip through them, and utilize the spaces left for expansion. If the latter is found to be the case the bolts and joint bars should be loosened enough, at all points showing expansion spaces, to permit the slip to take place. If the rails are found to be laid too tightly the only remedy is to remove a rail at proper intervals and replace it with a shorter one, then to even up the expansion by the space thus provided.

When joints get out of surface to an unusual extent the cause is apt to be poorly drained roadbed or chipped or battered rail ends. If due to wet roadbed the ballast should be cleaned and proper means of drainage provided. If the rail ends are chipped or battered the welders should be called to repair them.

Committee: C. W. Baldridge, assistant engineer, A. T. & S. F., chairman; Arthur Craine, district engineer, C. B. & Q.; John Sheehan, roadmaster, L. V.; B. E. Haley, general roadmaster, A. C. L.; Philip Chicoine, roadmaster, C. P.; G. H. Warfel, roadmaster, U. P.; T. W. Brown, roadmaster, C. R. I. & P.; aid C. E. Doty, supervisor, N. Y. C.

Discussion

That part of the report dealing with the influence of joint bars designed to furnish a support for the base of the rail on chipped end and base failures of the rail was discussed at length, many members stat-

ing that they could notice no difference as to chipping with the various types of joints. W. Lawrenz (C. & E. I.), attributed chipping to loose bolts which permitted the expansion to bunch. In reply Mr. Baldridge suggested that it was due to some joints being bolted so tightly as to prevent the equalizing of the expansion and cited an inspection of a considerable stretch of rail of 61, 65 and 69-lb. sections which had been in service 39 years, on which the expansion spaces were as much as ¾ in. in some cases and on which no battered or chipped ends were found. F. W. Easton (S. P.) told of an experience with some new rail laid with little expansion which developed 75 to 120 chipped ends to the mile in a short time. James Sweeney (C. & E. I.) stated that most trouble with chipped ends came with the introduction of rail of 90 lb. or heavier section and that chipping on rail of lighter sections was almost unknown. J. P. McAndrews (C. & N. W.) stated that it was very important to use proper expansion and to anchor rail promptly after laying to preserve the expansion openings. He cited a case where 110-lb. rail laid with no expansion spaces exceeding ¼ in., which developed flowed ends within 30 days and attributed this to heavy wheel loadings and high speed.

Mr. Baldridge called attention to the fact that the rail specifications permit a difference of 3/64 in. in the height of rails of the same section and that heavy loadings will tend to cause the end of the high rail to flow, no matter what expansion space is provided. J. B. Kelly (M., St. P. & S. Ste. M.) stated that in his opinion the trouble from chipped ends was often due to the burr left on the head of the rail when sawed, but Louis Yager (N. P.) cited studies of the flowed metal under the high local pressure developed under heavy wheel loads. Under these pressures the metal tends to flow laterally, but at the ends it flows longitudinally as well and produces a lip which later chips off. While saw burrs were sometimes the cause of chipping, it also occurred when the burr was milled off before laying the rail. He also attributed the freedom of the old light rail from chipping to the cold rolling it received under light traffic before being called on to carry the heavier loadings.

No specific instances of rail base failures due to the use of joints furnishing a support to the base of the rail with little or no bearing against the head of the rail were brought out in the discussion. W. A. Clark (Reading) stated that the Reading had been using this type of joint for four years with good results, the present year's program providing for 36,000 joints of this type. A motion to strike out the clause stating that such joints are quite likely to result in many base failures of the rails was lost.

The design of the joint to provide proper allowance for expansion was discussed and Mr. Baldridge called attention to the fact that the expansion of a 39-ft. rail amounted to 5/16 in. between 0 deg. and 100 deg. F., and that if this amount were not provided for in cold climates it would result in sheared bolts. E. P. Safford (N. Y. C.), D. O'Hern (E. J. & E.) and J. P. Corcoran (C. & A.) expressed themselves as favoring the laying of rail in the winter and stressed the importance of having sufficient expansion at that season to prevent tight rail in hot weather. Mr. Baldridge stated that the temperature of the rail should be taken for computing expansion, while Mr. O'Hern and others thought the temperature of the air should be used.

J. B. Martin (N. Y. C.) and Mr. O'Hern expressed a decided preference for the six-hole supported joint over the short four-hole joint, while others favored the shorter four-hole joint. The convention, by a rising vote, put itself on record as preferring the four-hole joint. The report was adopted without change.

The Repair of Track Tools

REPORT OF COMMITTEE

THE Committee on the Repair of Track Tools reports as follows:

1. We recommend that each railroad repair its own tools in preference to turning them over to any outside concern. If tools are returned to the manufacturer, it interferes with buying from other concerns and limits competition. It also requires railroads to invest in a larger stock of tools.

2. The bulk of the tools should be repaired in one central shop. Minor repairs can be made currently at the nearest point with the forces employed at roundhouses, car shops, etc.

3. The central shop should be under the supervision of the stores or the maintenance of way department, where special mechanics who are familiar with the requirements will make repairs. In the absence of competent mechanics to make repairs at roundhouses and car shops, all tools should be sent to the central shop.

4. There should be a store at the central repair point to handle all track tools for the system, at which requisitions can be filled for new tools needed and credit given to divisions which return tools for repairs.

5. We find that track chisels, claw bars and spike mauls are the most difficult tools to repair. The remedy for this lies with the manufacturers making tools of a better grade of steel and with the railroads purchasing the better grade without permitting price to be the dominating factor. If this is done, a mechanic will be able to do better work.

6. Tool dressing is an art by itself and requires study and experience on the part of a mechanic, but the best mechanics cannot make first-class tools from poor steel. Therefore, they should be furnished with the best of materials and up-to-date equipment in order to do first-class and economical work.

7. Track drills are not difficult to repair by a man who understands the work; yet we have numerous complaints from this source. The defect is mostly with the feed, lost motion in gears and sharpening the bits. New parts should be furnished for the gears and feed when worn out and bits should be ground to a perfect center and full cutting face.

8. Section and extra gang tools that need repair should be returned to the repair point at least once a month so that they can be repaired and returned to service. When extra gangs are taken off, all of their tools should be sent to the central shop and not stored on the divisions. The extra gang tools can be repaired during the slack season and be ready for service when needed. If stored on divisions, we frequently find that they are not fit for service when spring work starts. The storage of surplus tools or

those needing repairs in tool houses earns nothing.

9. The section foreman in charge of tools should be the judge when tools need repair and he should be responsible. He should inspect tools frequently, and see that all surplus tools or those that need repair are shipped in. Where supply trains are operated each month to distribute new tools and materials, the roadmaster should accompany the train and collect an old tool for each new one given out. He also should keep posted on the number of tools his men keep on hand.

10. It is difficult to set a standard of wear on tools before they should be classed as beyond repair, but, after careful study, your committee recommends that tools should not be repaired when worn beyond the following limits:

Adzes that will not grind 7 in. under the center of the eye.

Track chisels that will not dress 5 in. under the center of the eye.

Dirt picks that will not dress 11 in. under the center of the eye.

Spike mauls that will not dress 5½ in. under the center of the eye.

Claw bars that will not dress 8 in. from tip of claw to end of heel and be 3¼ in. thick from top face to bottom of heel and 2½ in. thick half-way between heel and end of claw, while the top face shall be 2 in. wide with a gradual rounding slope from heel to tip of claw.

Track shovels when the blades are worn to less than 10 in. in length. For quantity shoveling no shovel should be used that is not nearly full size and one that is worn off should be condemned for this purpose as the cost of the shovel is wasted quickly through inadequate size for quantity shoveling.

11. We recommend that a strap of iron ½ in. in width and ¼ in. thick be welded around the head of a track chisel and placed so that the top of the strap will be 3/16 in. below the top of the chisel. This will help greatly to prevent the head of the chisel from splitting and chips flying and makes a good safety device. A soft sledge should be used to strike chisels, rather than a spike maul; the life of the chisel can be prolonged if this is done, the sledge to be not more than 10 lb. in weight. A spike maul will last three times its present life if used for driving spikes and not for striking chisels. We think it would be a good plan for each railroad to have a few double-faced spike mauls made, with wide faces on both ends, for test on each division to do away with the small end of the spike maul, thus getting double wear out of mauls. With our present standards of guard rails and switches there is little use for the small end of a spike maul. Care should be taken to insure that the double face maul has a perfect eye, so that it will balance. We think there is no profit in drawing down old claw bars to make lining bars for usually these bars are too heavy. Neither will it pay to buy a new foot or claw and weld it on an old claw bar.

12. We recommend that it be the aim of all railroads to equip extra gangs, both steel and surfacing gangs, with the best tools available as their's are production jobs. Tools no longer fit for their use may be very efficient tools for section gangs after being repaired, as they do not use any one tool, such as spike mauls, claw bars and adzes, all of the time. The extra gang man uses these tools all the day and the production of every member of the gang is dependent on them, whereas the section man uses these tools intermittently. We do not mean to say that all section tools can be inferior, but in their kit of tools, they can get along very nicely with a part of their tools in less than A-1 condition, whereas extra gang tools should be in first-class condition. In grinding tools with high speed grinders, care should be taken not to get the tool hot and damage the temper. Cold water should be available to cool tools when necessary. This is particularly true with adzes and grass scythes.

13. At the central repair point, the storekeeper should have charge of all new and repaired tools, as the accumulation of track tools not in service will be at this point and be a guide as to the quantity that it is necessary to purchase. Also, surplus tools will be available for the whole railroad as contrasted with assembling them at several points, which latter practice tends to a surplus of tools and inequitable distribution.

14. It is our opinion that money is saved by buying good tools. It is an inducement for men to like their work. For illustration, take two men of equal working capacity, give one a No. 12 high-grade steel saw and the other a No. 6 or No. 7 steel saw. The man with the No. 12 saw will soon save the price of the saw in keeping it sharp and do more work than the man with the No. 6 or No. 7 saw, who cannot keep it sharp, although he spends more time than the other and finally becomes discouraged and quits. We have known men to buy tools in preference to using the tools furnished them.

The railroads are spending a large amount of money for tools. This committee thinks that the first requirement is to determine the proper design and specifications for tools. Either the railroads or the Roadmasters' and Maintenance of Way Association should appoint a committee on standard track tools which should meet twice a year to discuss and test tools and to solicit suggestions from time to time from the men who use them. When the designs are settled, the best method of keeping them in repair can be studied so as to get the maximum service.

Committee: B. C. Dougherty, roadmaster, C. M. & St. P., chairman; M. J. Dillon, roadmaster, M. P.; J. A. Roland, roadmaster, C. & N. W.; R. J. Yost, roadmaster, A. T. & S. F., and J. B. Martin, general inspector track, N. Y. C.

Discussion

T. F. Donahoe (B. & O.) objected to Paragraph 1, stating that it was the experience of the Baltimore & Ohio that tools could be repaired by manufacturers at a material saving in both money and time, particularly during the busy season for the railroad's mechanical department. J. P. Corcoran (C. & A.) and L. M. Denny (C. C. C. & St. L.) favored the repair of tools by railroad forces and reported good results under this plan. H. Van Gorder (C. & N. W.) pointed out that the railroads do not always have good tool men and reported some unsatisfactory experiences with tools repaired by company forces, but J. B. Martin (N. Y. C.) contended that there was no reason why the railroads could not employ as good mechanics as the manufacturers. A. M. Clough (N. Y. C.) stated that the New York Central followed the practice of repairing tools with company forces and said that the results obtained were good.

In discussing the issuing of tools, F. W. Easton (S. P.) reported excellent results in the exchange of tools under the supply car system and stated that no difficulty had been experienced in effecting a simple plan for supplying the foreman with additional tools when he needed them, without the necessity for special requisitions. J. B. Kelly (M. St. P. & S. S. M.) P. J. McAndrews (C. & N. W.) and C. W. Baldridge (A. T. & S. F.) pointed to the need of

greater simplification in the procedure for supplying additional tools to gangs in cases where it was necessary to increase the supply of tools or to replace tools that had been lost so that no old or defective tool could be turned in. The committee's report was accepted without change.

The Track Supply Exhibit

FIFTY-SIX manufacturers of equipment, devices and materials used in tracks and their maintenance participated in the exhibit of the Track Supply Association which was held concurrently and on the same floor with the Roadmasters' convention. The number of firms exhibiting was smaller than at some of the previous exhibits, but was all that could be accommodated in the available space adjacent to the convention hall. Applications for space were received from more than 40 firms after all space had been assigned. Because of the lack of room and the fact that some of the exhibitors had to present their displays in isolated rooms, the exhibit did not present as attractive an appearance as at some of the previous shows, although the individual exhibits were well up to the established standards.

The officers of the Track Supply Association who were responsible for the success of the exhibit are: President, L. C. Ryan, Oxweld Railroad Service Company, Chicago; vice-president, A. H. Told, Positive Rail Anchor Company, Marion, Ind.; secretary-treasurer, W. C. Kidd, Ramapo-Ajax Corporation, Hillburn, N. Y.; directors, J. H. Horn, National Lock Washer Company, Newark, N. J.; Frank McAllister, Kalamazoo Railway Supply Company, Kalamazoo, Mich.; W. W. Glosser, Verona Tool Works, Pittsburgh, Pa., and L. P. Shanahan, American Steel and Wire Co., Chicago; advisory directors, R. A. Van Houten, Sellers Manufacturing Company, and E. T. Howson, *Railway Engineering and Maintenance*; ex officio director, J. J. Cozzens, Union Switch & Signal Company; honorary director, G. W. Morrow, president, Roadmasters' and Maintenance of Way Association.

At the annual meeting on Wednesday afternoon the following officers were elected for the ensuing year: President, A. H. Told, Positive Rail Anchor Company, Marion, Ind.; vice-president, J. Howard Horn, National Lock Washer Company, Newark, N. J.; directors: F. E. McAllister, Kalamazoo Railway Supply Company, Kalamazoo, Mich.; W. W. Glosser, Verona Tool Works, Pittsburgh, Pa.; L. P. Shanahan, American Steel & Wire Company, Chicago; and B. J. Wilson, Pocket List of Railway Officials, Chicago.

List of Exhibitors

American Chain Company, Bridgeport, Conn.; guard rail clamps, car replacers, rail benders, one-piece guard rail, compromise joints; J. J. O'Connel and W. P. Burleigh.

American Fork & Hoe Company, Cleveland, Ohio; rail anchors and tapered rail joint shims; F. C. Stoell, H. C. Christy, L. D. Gibson, Emmett Keough, A. F. Fifield, S. L. Henderson, John T. Reagan and R. P. Wilkins.

American Hoist & Derrick Company, St. Paul, Minn.; illustrations and photographs of ditchers and shovels; George Prest, W. B. Maurer and Miss Helen Hoeller

American Steel & Wire Company, Chicago; fencing, posts, signal wire and bonds; L. P. Shanahan, H. A. Squibbs, H. S. Lockwood, D. F. Waterman, J. W. Collins and A. W. Froude.

American Valve & Meter Company, Cincinnati, Ohio; interlocking and gearless switch stand and safety locking device; J. T. McGarry, and D. J. Higgins.

Balkwill Manganese Crossing Company, Cleveland, Ohio; miniature of an articulated cast manganese steel crossing; S. Balkwill.

Bethlehem Steel Company, Bethlehem, Pa.; rail anchors, switch stands, hook flange guard rail and gage rods; N. E. Salsich, J. F. Hennessy, F. M. Hoffman, G. H. Riddle, R. A. Malone, R. P. Deghuee, M. A. Vickers, G. A. Richardson, J. C. Tobias and G. L. Moore.

Buda Company, Harvey, Ill.; section motor car, motor car wheel, track drill and track liner; R. B. Fisher, J. L. Artmaier, G. A. Secor, A. J. Walch, R. M. Blackburn and W. Stratton.

Chicago Malleable Castings Company, Chicago; rail anchor tie plates, and literature on bumping posts; Warren Osborn, J. S. Llewellyn, J. H. Slawson, W. L. Beaudway and C. A. Benz.

Chicago Steel Foundry Company, Chicago; track liner; R. H. Bloxham and David Evans.

Cleveland Railway Supply Company, Cleveland, Ohio; flangeway guard, solid trough and open trough foot guard, guard rails, switch stands and photographs of locomotive cranes; W. H. Neeson, H. P. Blum, F. A. Peck, Q. J. Winsor and F. W. Cherry.

Creepcheck Company, Inc., Hoboken, N. J.; creepchecks; T. D. Crowley, P. E. Browne, Frank Reagan, R. R. Dinklage and N. J. Leavitt.

Crerar, Adams & Co., Chicago; hand and power bonding drills, track drills, track tools, jacks, track liners and handles; Russell Wallace, J. A. Martin, G. D. Bassett, E. C. Peohler and Charles Grentz.

Duff Manufacturing Company, Pittsburgh, Pa.; track jacks and tie spacer; C. N. Thulin and E. E. Thulin.

Edison, Thomas A., Inc., Bloomfield, N. J.; electric lighted switch lamp, battery cells and parts; P. A. Garrity and R. J. Frost.

Electric Tamper & Equipment Company, Chicago; gas electric power unit; Corwill Jackson, H. W. Cutshall, R. O. Shaffer and V. G. Cartier.

Fairbanks, Morse & Co., Chicago; section car; F. M. Condit, E. M. Fisher, B. S. Spaulding, F. J. Lee, D. K. Lee, E. C. Golladay, J. L. Jones, G. Howard, C. B. O'Neil, H. L. Hilleary and G. W. Lewis.

Fairmont Railway Motors, Inc., Fairmont, Minn.; light inspection car, and section motor car engine; W. F. Kasper, W. D. Brooks, E. R. Mason, K. K. Cavins, L. R. Payton and C. H. Johnson.

Hackmann Railway Supply Company, Chicago; track liner and heel block; Frederich Hackmann, Joseph J. Franzen and Arthur Schmidt.

Hayes Track Appliance Company, Richmond, Ind.; derail and operating stand, light portable derail and bumping post; H. J. Mayer, S. W. Hayes, Edgar W. Brown and E. L. Ruby.

Hubbard & Co., Pittsburgh, Pa.; shovels, track tools and nut locks; W. H. Remmel, M. Lasher, H. M. Pforsich and J. S. Wincrantz.

Ingersoll-Rand Company, New York; pneumatic tie tamper, rail drill, nutting machine, bonding drill, concrete breaker, hammer and chipper; William H. Armstrong, George W. Morrow, L. A. Luther, T. H. Weigand, E. F. Kultchar and Fred Ursem.

Jordan Company, O. F., East Chicago, Ind.; model of spreader and moving pictures; A. L. Greenabaum, J. C. Forbes, C. H. Staples, A. W. Banton, A. Jones and J. F. Curtis.

Kalamazoo Railway Supply Company, Kalamazoo, Mich.; motor cars; Frank E. McAllister, R. E. Keller and G. E. Bridge.

Kentucky Rock Asphalt Company, Louisville, Ky.; photographs and literature on Kentucky rock asphalt; W. F. Pollard, W. A. Brownfield and T. J. Foy.

Lundie Engineering Corporation, New York; tie plates and rail anchors; L. B. Armstrong, Eugene Brandeis and George Nibbe.

Magor Car Corporation, New York; photographs of dump cars; J. J. McGarrigle.

Maintenance Equipment Company, Chicago; friction car stop and switch point protector; H. C. Holloway, J. A. Roche, Emmons Overmier, A. L. Arnold and E. J. Van Patten.

McMyler Interstate Company, Cleveland, Ohio; switch stands and photographs of locomotive cranes; H. C. Odenkirk.

Mechanical Manufacturing Company, Chicago; photographs and literature on bumping posts; H. E. Johnson.

Mudge & Co., Chicago; motor cars; R. D. Sinclair, Albert C. Force, A. R. Fletcher, V. Pagett, F. C. Whitehouse, L. B. Ryan, C. P. Benning, F. H. DeBrun, W. L. Currier and W. D. Achuff.

National Lock Washer Company, Newark, N. J.; spring washers; J. Howard Horn, W. R. Hillary, R. L. Cairncross, J. J. Crawford, W. H. Reaves and F. B. Archibald.

Northwestern Motor Company, Eau Claire, Wis.; transmission drive for heavy duty motor cars, light inspection car and photographs and literature on motor cars, discing equipment, gas-electric power plant and trailer; F. W. Anderson, Otis B. Duncan and F. C. Datesman.

Oxweld Railroad Service Company, Chicago; welding apparatus; L. C. Ryan, F. C. Hasse, C. A. Bloom, W. E. Campbell, F. J. Duffie, J. J. Graham, A. S. Jones, F. H. Lurquin, F. J. Lynch, J. E. Winslow, W. A. Hogan, A. N. Lucas, H. W. Schultz, W. A. Champieux, W. H. Kofmehl and Wm. Leighton.

Pocket List of Railroad Officials, New York; copies of publication; J. Alexander Brown and B. J. Wilson.

P. & M. Company, Chicago; anti-creepers and bond wire protectors; D. T. Hallberg, F. A. Preston, George E. Johnson, W. H. Reaves, M. K. Ruppert, P. H. Hamilton, S. M. Clancey, J. J. Gallagher and Wm. Cunningham.

Positive Rail Anchor Company, Marion, Ind.; girder type guard rail, rail anchors and guard rail plates; A. H. Told and L. C. Ferguson.

Q. & C. Company, New York; one-piece manganese guard rail, guard rail clamp, compromise joint, switch point guard, insulated joint, steel fence post and derails; R. J. McComb, J. L. Terry, and Lewis Thomas.

Racine Tool & Machine Company, Racine, Wis.; rail cutting machine for use in track; J. M. Jones, Ray Fuller, M. E. Erskine and E. R. Larson.

Rail Joint Company, New York; insulated joints, compromise joints, standard joints, head-free joints, reinforced joints and track liner; Alex Chapman, V. C. Armstrong, A. E. Condit, Jr., D. L. Braine, H. C. Hickey, C. B. Griffin, C. H. Larson, Thomas Ryan, J. N. Meade, M. Markley, W. A. Gadd, Charles Jenkinson and B. G. Braine.

Railroad Accessories Corporation, New York; power track drill and ballast bucket; B. A. Lundy.

Railroad Supply Company, Chicago; tie plates; W. S. Boyce, R. E. Bell, G. T. Williams, M. J. Fox, John Hensel, T. H. Cole and A. H. Smith.

Railway Engineering and Maintenance, Chicago; copies of *Railway Engineering and Maintenance*, Railway Age, Railway Engineering and Maintenance Cyclopedia, Roadway and Track, and Simplified Curve and Switch Work; L. B. Sherman, E. T. Howson, F. C. Koch, W. S. Lacher, J. M. Rutherford, F. M. Patterson, H. A. Morrison and H. E. McCandless.

Railway Review, Chicago; copies of publication; B. V. Crandall, J. E. Gougon, J. A. Walsh, George E. Boyd and A. D. McIntyre.

Ramapo-Ajax Corporation, Hillburn, N. Y.; automatic switch stand, positive switch stand, double shoulder switch plate, switch clip, adjustable switch brace, guard rail clamp, forged braces and rail expander; J. B. Strong, J. E. Davidson, T. E. Akers, D. E. Hilton, Dickson Fairback, W. J. Fairback, Paul Hoffman, W. Bender, J. V. Houston, C. A. Carlson, W. Janicki and G. M. Cooper.

Reade Manufacturing Company, Jersey City, N. J.; operating miniature work train for distribution of chemical weed killer; R. W. Pritchard.

Reliance Manufacturing Company, Massillon, Ohio; spring washers; H. J. McGinn, R. Shireman and E. C. Gross.

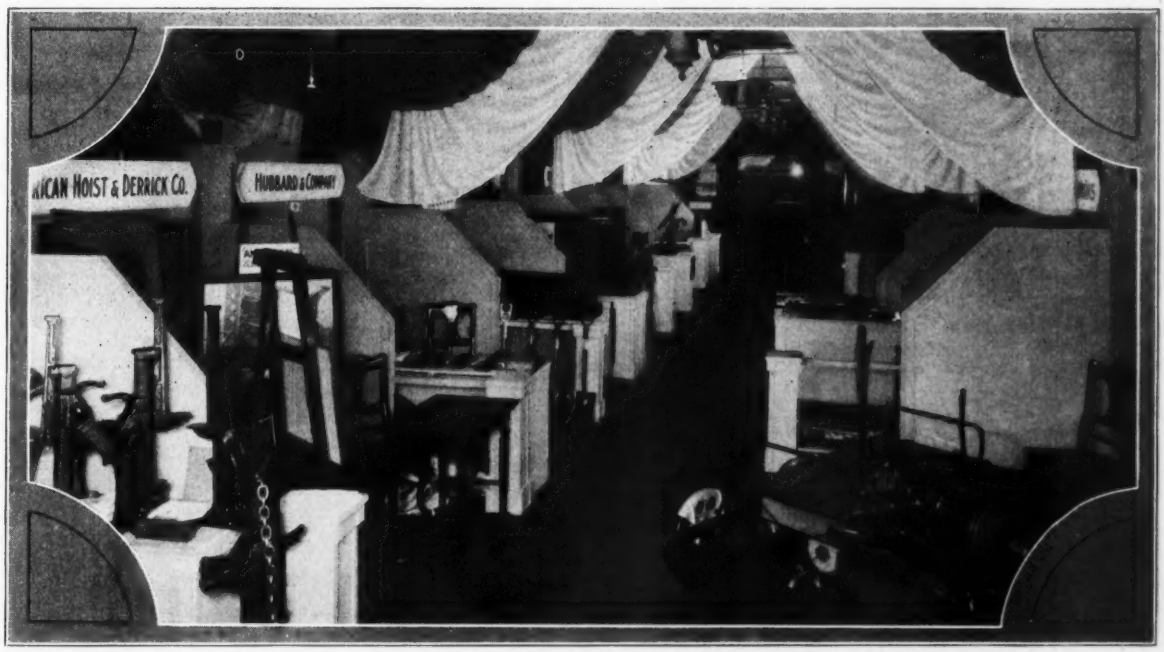
Sellers Manufacturing Company, Chicago; wrought iron tie plates and wrought iron guard rail tie plates; R. A. Van Houten, J. M. Sellers, G. M. Hogan and R. J. Platt.

Sinning Track Liner Company, Ramsey, Ill.; track liner; F. R. Sinning, J. A. Moffitt, Frank Reagan and Stanley Smith.

Skelton Shovel Company, Inc., Dunkirk, N. Y.; track shovels; E. W. McCarty, H. C. Branahl and C. A. Trigg.

Templeton, Kenly & Co., Ltd., Chicago; track jacks, bridge jacks, emergency jacks and tie spacing shoes; James L. Crowley, George L. Mayer and W. B. Templton.

Union Switch & Signal Company, Swissvale, Pa.; insulated rail joints; J. J. Cozzens.



View of Part of the Track Supply Exhibit

Verona Tool Works, Pittsburgh, Pa.; track tools, nut locks, track jacks, rail joint springs, and rail anchors; W. W. Glosser, W. C. Dawkins, A. C. Laessig, B. M. Cheney and C. G. Ericson.

Warren Tool & Forge Company, Warren, Ohio; adzes, clawbars, lining bars, picks, spike mauls, sledges, hammers, track chisels, wrenches and gages; H. C. Mull and J. R. Konold.

Woolery Machine Company, Minneapolis, Minn.; motor car engines and parts; D. A. Woolery, Wm. S. Miller, C. E. Berg and J. T. Stephenson.

Zenith Shovel Company, Chicago; shovels; W. H. True and Hans N. Nilssen.

Non-Exhibiting Members

Andrix Lock Washer Company, Adrian, Mich.
Cleveland Frog & Crossing Company, Cleveland, Ohio.
Morden Frog & Crossing Works, Chicago.
National Malleable & Steel Castings Company, Cleveland, Ohio.
Parsons Company, The, Newton, Iowa.
Pettibone, Mulliken Company, Chicago.
Railway Purchases and Stores, Chicago.
St. Louis Frog & Switch Company, St. Louis, Mo.
William Wharton, Jr. and Co., Easton, Pa.
Wyoming Shovel Works, Wyoming, Pa.

What's the Answer?

What Our Readers Have to Say on Current Questions That Perplex Those Engaged in Maintaining Tracks, Structures and Water Supply Facilities

QUESTIONS TO BE ANSWERED IN THE DECEMBER ISSUE

1. *What is the best method of protecting ties from fire where ashpans must be cleaned on tracks where no cinder pits are available?*

2. *What are the relative advantages and disadvantages of stringers spanning two panels and those of single panel length for open deck trestles?*

3. *Is it necessary to provide an extra rail on rail rests on every mile or can this interval be increased, possibly to the extent of providing one or two rails on a rail rest at the tool house for the entire section?*

4. *Under what conditions is it advisable to place the operation of pump houses in the hands of agents or other station employees?*

5. *What is the best method of maintaining line and surface at turn-outs.*

6. *In depositing concrete in cofferdams where pumping must be done are there any objections to stopping the pumps at the end of the day's work and allowing the water to submerge the fresh concrete, the pumps being started by the night watchman in time to permit work to be resumed in the morning?*

7. *To what extent should foremen be required to check the ties received by them to see that they comply with the standards for quality and grade?*

8. *What is the best method of flashing for built-up roofing on brick buildings?*

Treated Timber for Railway Buildings

To what extent is the use of treated timber economical for frame buildings for railway purposes?

It Should Be Used Wherever the Timber Is Exposed to Dampness

By C. E. Weaver

Chief Engineer, Central of Georgia, Savannah, Ga.

We find the use of treated timber economical for frame buildings in all cases where such timber is exposed to the weather, where it is exposed to dampness or where it is so located as to preclude a free circulation of air.

Our present practice is to use treated timber for buildings to the following extent: Joists and sills for passenger and freight room floors in depots and for timber platforms (treated pile heads are used when the the platforms have timber supports), window and door frames, sash and louvres in enginehouses and shop buildings, coaling stations and similar structures; sills and plates resting on continuous masonry foundations; studding in buildings covered with stucco; wood block flooring in shops and enginehouses; wooden shingles, porch steps, stringers, etc., for section houses; and siding for buildings where the appearance of the treated lumber is not objectionable and where the buildings do not have to be painted to conform with the adopted color standards.

In other words we try to use treated lumber wherever we can, when our experience shows that untreated lumber has been subject to decay. Our experience is based almost entirely on the use of yellow pine lumber of the grades now obtainable, while our costs for treatment are very favorable to the use of treated material. The availability of other and more durable species of lumber at reasonable prices and higher costs for treatment might show different results in other sections of the country.

Treated Timber Used for Freight House Floors on Cinder Fills

By Daniel Mack

Architect, Delaware, Lackawanna & Western, Hoboken, N. J.

With the exception of railroad ties and undersills under temporary structures, we do not make a practice of using treated timber for frame buildings to any extent. The only places we have used this material for buildings, other than as mentioned above, are in the floors of certain freight houses which were built directly on cinder fills. In these structures 3 in. by 4 in. short leaf pine sleepers were laid on 20-in. centers, on a well packed and water-soaked cinder bed and sub-floors of 2-in. by 8-in. planks of the same material were laid diagonally across the sleepers, both the sleepers and the sub-floor having been given a 10-lb. treatment of creosote. The finished floor consisted of factory grade T. & G. maple.

There Is Almost No Limit to Its Economical Use

By L. H. Harper

Superintendent Creosote Plant, Central of Georgia, Macon, Ga.

There are many places where treated timber can be used economically in frame buildings on railways. The sills of frame depots, section houses and similar structures, even though not coming in direct contact with the ground, are exposed to dampness and other atmospheric

conditions which soon rot out untreated wood. The sills, joists and flooring of platforms are all exposed and should be treated. The posts, braces, roof joists, and even the sheathing of open sheds over transfer platforms, automobile unloading platforms, etc., should all be of treated timber. The cut-offs from treated trestle piles often can be used to advantage as posts under platforms and small buildings. Creosoted shingles make an excellent roof covering for section, tool and pump houses.

There is almost no limit to the economical use of treated wood in both large and small railway structures, and this is evidenced by the ever widening range of uses to which it is being put by the railways.

Floors for Roundhouses

What type of floors is best for roundhouses sheltering heavy power?

Creosoted Yellow Pine Blocks on a Concrete Base Are Recommended

By Hugo W. Hesselbach
Architect, Southern, Washington, D. C.

In my opinion long leaf yellow pine blocks, 3 in. in depth, treated with 12 lb. of creosote to the cubic foot and laid on a 5-in. concrete base with a pitch cushion and pitch joints, are best suited for floors for heavy duty roundhouses. I have specified floors of this description for this purpose during the past 10 or 12 years and the results have been uniformly satisfactory.

Floors Should Be of Permanent Construction

By Supervisor of Buildings

Floors for roundhouses sheltering heavy power should present a smooth surface to allow trucking of heavy materials for such emergency repair work as must be done on the locomotives while they are in the roundhouse, and which will at the same time have resistance to wear. For this purpose creosoted wooden blocks laid on a concrete base have proved very satisfactory and are used to a large extent. Concrete floors are also used but they are apt to be slippery and are also liable to crack. Vitrified brick makes a durable floor but has a rough surface, which makes it difficult to truck heavy loads.

Jacking blocks supported by the pit walls should be provided or if this was not taken care of in the original design the foundation of the floor next to the pits should be made heavy enough to support them. With any type of floor sufficient crown should be given the floor so that the water will drain to the engine pits.

Hard Wood and Soft Wood Ties

Where hard wood and soft wood ties are used is it good practice to lay each group out of face by itself on tangent track?

The Two Kinds Should Be Used Separately

By P. J. McAndrews
Roadmaster, Chicago & North Western, Sterling, Ill.

Where hard wood and soft wood ties are furnished for use in tangent tracks I believe it is the best practice to use them out of face in separate stretches of track, as in my judgment the mixing of soft wood and hard wood ties has a tendency to make the track ride less smoothly than when the ties throughout a stretch are of uniform quality and equal resistance.

While many trackmen have felt that when soft wood ties were furnished gage could be maintained better by having hard wood and soft wood mixed, I believe the lesser resistance of the soft wood ties to the mechanical wear of the rail or tie plate justifies laying the soft wood ties in stretches out of face on heavy traffic, high speed lines, the question of maintaining gage being taken care of through the almost universal use of suitable tie plates.

For the economical maintenance of track to a high standard, the ties should be uniform in size and quality.

Soft Wood and Hard Wood Ties Should Not Be Inserted Indiscriminately

By Roadmaster

While the practice of using hard wood ties out of face on curves has been followed for many years on most roads using both hard wood and soft wood ties, the practice of segregating the two kinds of tangent track has not been so widely adopted. There is a considerable difference in the resistance to wear due to traffic between the two kinds of ties and better results as to the riding qualities of the track will be obtained if each kind is used in continuous stretches on heavy traffic lines.

Before tie plates came into such extensive use as at the present time it was often desirable to mix the ties to take advantage of the superior gage-holding qualities of the hard wood ties but with the use of tie plates this practice is not so necessary and better results are obtained by keeping each kind segregated.

The Effect of Double-Header Trains on Track

Do the two engines in a double-header train cause more damage to track than the same engines would in separate trains?

Definite Information Is Not Available

By A. F. Dorley
Assistant Engineer Maintenance of Way, Missouri Pacific, St. Louis, Mo.

My personal opinion is, and always has been, that the answer is "Yes." In other words, I believe that some elements of wear and tear of track will be found to be aggravated by the handling of a given tonnage in "double-header" trains when these elements are compared with the damage resulting from the same tonnage handled in trains with single engines. However, the problem is so abstruse and offers conditions so involved and complex, that I do not believe it can be solved correctly without a technical investigation.

It Depends on the Curvature and Grade Line

By A. A. Woods
Chief Engineer, Lines West, Southern, Cincinnati, Ohio

There is a general impression, shared by myself, that a double-headed train is harder on track than two single-headed trains with the same type and weight of engine. However, there are enough different factors involved so that the answer to the question should be a matter of fact based on actual observation and experience. The Southern does not generally make a practice of double-heading freight trains, so that I do not feel that I have positive facts and information to contribute to this discussion. It is, of course, obvious that the increased draw bar pull with double-headed engines increases tremendously all lateral forces affecting line and surface,

so that so far as the main draw bar pull of the train is concerned, there should be no question but what double-heading is more severe on track, providing comparison is made with engines of the same weight. I suspect the answer to the question is more dependent upon physical characteristics of the line as to curvature and character of grade line than it is on the total weight of the locomotive units.

Heating Pump Houses

To what extent is it necessary to maintain heat in pumping stations which are not operated continuously and what type of heating plant is best for this purpose when steam from a nearby source is not available?

Varies With Climate and Type of Equipment

By B. W. DeGeer

Engineer Water Service, Great Northern, St. Paul, Minn.

The necessity for heating pumping plants during the hours that they are idle naturally depends largely upon the climate where they are located. In the cold parts of the country where gasoline or oil engines are used for power, it is good practice to keep the pumphouse above freezing temperature at all times. In small, well built pumphouses large stoves can be relied upon for this service. In very severe weather it may be necessary to attend to the fire at midnight, but under normal conditions, if the pumphouse is well heated in the evening and the fire banked, no attention is required until the following morning. In treating plants, hot water heating plants have proved to be a very satisfactory source of heat. In electrically-driven plants, operated automatically, small electric heaters, placed in direct contact with the pump and pipe lines, have proven satisfactory. The pumphouse should be heavily insulated in such installations, and the door opened only when absolutely necessary, a storm house being provided outside of the door to prevent unnecessary cold air from entering.

Stoves Are Best for Small Pumping Stations

By C. Harry Fox

Engineer Water Service, Canadian Pacific, Winnipeg, Man.

In general when steam is not available to heat small pumping stations, that is done by the use of stoves. Many of these small pumping stations are operated quite intermittently, possibly every third or fourth day, in which case fires are not kept up, but it is arranged so that all pipes and pumps can be drained.

The Best Time for Treating Soft Spots in the Roadbed

What time of year is best for the treatment of soft spots in the roadbed?

The Work Should Be Done in the Spring

By R. L. Longshore

Division Engineer, Wabash, Montpelier, Ohio

With the climatic conditions obtaining in northern Indiana and Ohio work of this kind should be started just as soon as the frost is out of the ground, and completed not later than June 15. Unless a very serious roadbed condition exists no work of this kind should be done after June 15. The spring rains are over by this date, and it has been our experience that the roadbed begins to dry out on or about this date, and this drying out and hardening continues up to the fall rains of September or October, and in some years until frost enters the ground. Any work after June 15 results in changes in the roadbed conditions at a time when it is not possible to line and surface tracks to conform with this changed condition.

We have found from experience that soft roadbed treatment carried out later in the year results in a worse track condition during the following winter than was experienced before. This, as explained above, is occasioned by lack of time to line and surface the track, or adjust the track structure to the changed roadbed condition brought about by improved drainage.

A Method That Can Be Used in any Season

By J. Morgan

Supervisor, Central of Georgia, Leeds, Ala.

My method of treating soft spots is to drive sound timber, such as untreated track ties or secondhand bridge timbers, cut to about 8-ft. lengths, about 10 in. from the end of the track ties, spacing them along the roadbed about the same as track ties, and confining the work to the soft spot only, as driving the timbers into the solid roadbed is not only a waste of time and money but will create unsatisfactory conditions. Sound timber will not rot when driven into the material that forms the usual soft spot. I have been following this practice for 21 years and have never had any trouble when the timber was driven properly.

Protecting Horizontal Holes in Creosoted Timber

What is the best method of applying creosote to horizontal holes bored in treated timbers, such as holes for sway brace bolts?

Paint the Bolts With Creosote

By I. L. Brown

General Foreman, Bridges and Buildings, Atchison, Topeka & Santa Fe, Arkansas City, Kan.

The only way that I have ever tried to place creosote in horizontal holes is to bore the hole a little sloping and then use a small squirt can for inserting hot creosote in the hole. After placing the bolt in the hole I use the squirt can again. This did not prove successful on account of the hot creosote burning the men's hands when using the can. The best method, in my judgment, is to paint the bolts with creosote before inserting them, using an old paint brush.

A Method of Applying Creosote to the Holes

By Supervisor of Bridges

The importance of protecting creosoted timbers against the introduction of the spores of fungi is so well recognized that it is now the custom on many roads to frame the timber to obviate the necessity of cutting the treated timber. In the case of pile trestles it is manifestly impossible, as a practical matter, to bore the holes for sway brace bolts until after the piles have been driven and such holes often provide starting places for decay in the interior of the timber, unless they are protected by an application of creosote or some other preservative agent.

One method that has been used successfully to do this is to plug up one end of the hole temporarily and to use clay or some other plastic material to form a cup-like appendage on the side of the pile around the bottom and sides of the open end, carrying the sides at least as high as the top of the hole. Creosote oil, warmed

sufficiently to allow it to flow readily, may then be introduced into the hole by means of a funnel or oil can with a curved spout, and allowed to remain long enough so that the untreated wood may absorb a sufficient amount of the creosote to protect it from decay.

Assistant Foremen for Large Gangs

In large extra gangs what is the maximum number of men an assistant foreman should be expected to supervise for different kinds of work and different classes of labor?

Twenty-five to Thirty Is a Fair Average

By W. H. PENFIELD

Engineer Maintenance of Way, Chicago, Milwaukee & St. Paul, Chicago

I think that 25 men is a fair average. There will be certain classes of laborers and certain classes of jobs where there will be fewer men for each assistant foreman, and also many cases where one assistant foreman will be able to supervise 40 or 50 men. As stated above, I think that 25 to 30 men is a fair average.

Variations Are Too Great to Fix a Definite Number

By A. C. MACKENZIE

Engineer Maintenance of Way, Canadian Pacific, Montreal, Que.

The quality of labor will vary in different locations to such an extent, and there is such variation in the individual ability of assistant foremen, that it is not possible to say in a general way how many men an assistant foreman is capable of supervising. On some divisions the extra gang laborers are green men requiring a great deal of supervision, while on other divisions experienced men work year after year on the same extra gang and necessarily require less supervision. In general, assistant foremen are used only in rail laying and ballasting operations and the largest gang having a foreman and assistant foreman would consist of about 60 men, while on certain rail laying operations, such as spiking joints and centers ahead of main spike gang, the assistant foreman would be in charge of only 10 men.

Negro Labor in the South Should Have an Assistant Foreman for Every 15 Men

By J. MORGAN

Supervisor, Central of Georgia, Leeds, Ala.

With colored labor I find the best results can be had with an assistant foreman to every 10 or 15 men on general track work. There are cases where one man can handle more to advantage, but on the whole there should be an assistant to every 15 men.

A Triple-Span Culvert on the Santa Fe in Arizona

Cross-Tie Purchases In 1925

ACCORDING to data collected by the Department of Commerce in co-operation with the Department of Agriculture, 111,351,759 ties were purchased by the steam and electric railroads in 1925, as compared with 135,976,117 in 1923, the steam road purchases amounting to 105,163,800 in 1925 and to 129,133,347 in 1923, a reduction of approximately 20 per cent.

The number of treated and untreated ties, separated by classes and kinds of wood, purchased in 1925, is shown in the accompanying table, switch ties and bridge ties being reduced to an equivalent in cross ties of 32 f.b.m. The figures are preliminary and are subject to such correction as may be necessary upon further examination of the returns.

The data show that oak ties still constitute a large part of the ties purchased, amounting to 47,255,603, or 42½ per cent of the total, but showing a falling off in percentage from 1923, when they accounted for almost 50 per cent of the total. Pine ties, second in point of numbers, were purchased to the amount of 20,421,350, or about 18 per cent, while the 12,708,863 Douglas fir ties purchased constituted about 11½ per cent of the total, the percentages for the pine and Douglas fir ties showing little change from 1923. The decrease in the tie requirements for 1925 undoubtedly reflects the benefits of timber preservation.

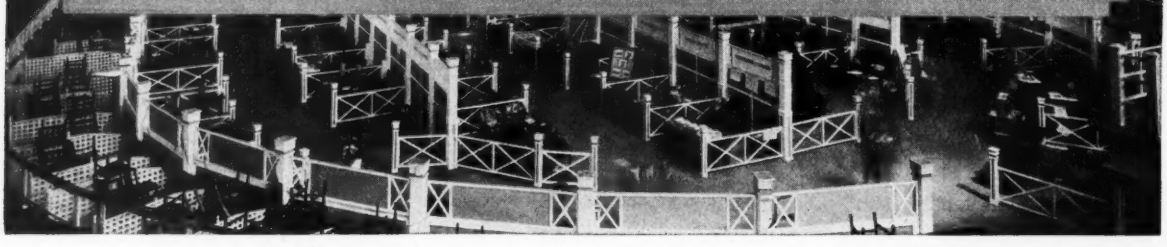
Statistics on Cross-Tie Purchases

Class of Ties and Kind of Wood	Total	Purchased by Steam Railroads		Purchased by Electric Railroads	
		Treated	Untreated	Treated	Untreated
All Classes:					
1925	111,351,759	13,193,120	91,970,680	1,174,312	5,013,647
1923	135,976,117	*	129,133,347	*	6,842,770
Class U—(Ties Which May Be Used Untreated)					
Group Ua:					
Heart black locust	2,959	.....	709	.....	2,250
Heart white oaks	22,230,772	281,621	20,296,838	94,184	1,558,129
Heart black walnut	112	.....	112	.....	.....
Group Ub:					
Heart Douglas fir	12,036,226	628,946	10,501,203	36,345	869,732
Heart pines	6,388,373	854,294	4,808,438	289,082	436,559
Group Uc:					
Heart cedars	2,646,441	.....	2,291,734	30,078	324,629
Heart cypress	4,844,902	1,021	4,800,707	300	42,874
Heart redwood	1,195,660	29,121	915,563	.....	250,976
Group Ud:					
Heart chestnut	2,960,643	17,094	2,151,256	25,690	766,603
Not specified	136,860	.....	136,860	.....	.....
Class T—(Ties Which Should Be Treated)					
Group Ta:					
Ashes	448,830	17,826	427,408	2,666	930
Hickories	590,056	4,708	582,554	2,666	128
Sap black locust	288	.....	288	.....	.....
Red oaks	22,839,278	4,554,077	17,602,700	423,052	259,449
Sap white oaks	2,185,538	220,455	1,798,579	8,386	158,118
Sap black walnut	2,379	.....	131	.....	2,248
Not specified	1,203,965	1,203,965	.....	.....	.....
Group Tb:					
Sap cedars	785,690	8,010	679,598	.....	98,082
Sap cypress	255,066	54,142	192,153	.....	8,771
Sap Douglas fir	672,637	1,212	601,516	.....	69,909
Hemlocks	2,051,292	500	2,048,430	.....	2,362
Larches	2,366,775	12,371	2,249,953	6,033	98,418
Sap Pines	14,032,977	3,803,373	9,975,745	249,123	4,736
Sap redwood	6,954	.....	6,954	.....	.....
Group Tc:					
Beech	1,619,179	211,434	1,403,901	3,719	125
Birches	1,803,081	370,761	1,432,070	.....	250
Cherries	11,089	1,003	7,838	.....	2,248
Gums	3,731,112	236,289	3,478,555	902	15,366
Hard maples	2,900,132	217,313	2,679,412	2,086	1,321
Not specified	271,942	63,812	208,130	.....	.....
Group Td:					
Sap chestnut	109,473	.....	74,430	.....	35,043
Elms	171,315	21,616	149,699	.....	.....
Soft maples	220,389	22,279	197,645	.....	465
Poplars	1,501	.....	1,501	.....	.....
Spruces	401,528	312,619	88,233	.....	676
Sycamore	108,206	22,779	85,427	.....	.....
White walnut	12,718	2,600	6,868	.....	3,250
Not specified	39,250	3,027	36,223	.....	.....
Miscellaneous:					
Cottonwood	9,983	.....	9,983	.....	.....
Magnolia	14,852	14,852	.....	.....	.....
White fir	41,336	.....	41,336	.....	.....

*Not reported separately; included with untreated ties.

Getting the Manufacturers' Help

Current Developments in New and Improved Labor Saving Appliances



Rust-Proofing Spring Washers

THE NATIONAL Lock Washer Company, Newark, N. J., has adapted the Parkerizing process of rust-proofing metals to its spring washers to make them entirely non-corrosive. The railroads have long recognized the seriousness of the problem of overcoming the corrosion of track materials, particularly at the joints, and they have spent vast sums of money to develop and to utilize means of preventing this corrosion and thereby prolonging the life of the component parts of their track.

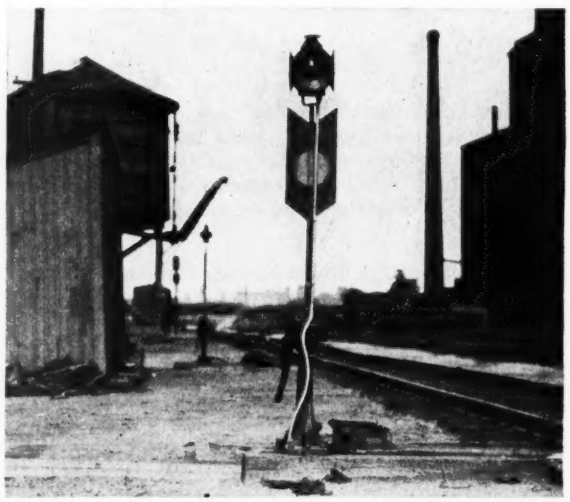
The National Lock Washer Company started research work for the purpose of rust-proofing its spring washers and especially its Improved Hipower spring washers about five years ago. As a result of this work and of extensive tests in the laboratory and shop and in actual service in the track, it was found that while many expedients could be employed to make the spring washers rust-proof, the majority of these processes produced only temporary results. Of the various permanent methods that can be employed, the majority were found to so affect the physical properties of the steel as to eliminate them from consideration for this purpose.

For the past three months the National Lock Washer Company has been working with the Parker Rust-Proof Company in an effort to adapt the Parkerizing process to spring washers as a result of which it has been ascertained that this process, for all practical purposes, produces permanent results and at the same time does not affect the physical properties of the steel in the spring washers. The Parkerizing process differs from most rust-proofing processes in that basically it is not a plate but the actual skin of the material that is Parkerized is converted into a basic iron phosphate which is impervious to rust or corrosion.

Lighting Switch Lights by Electricity

AS a result of the success attained by the railroads in the substitution of electric for oil lights in automatic signals, interlocking signals, train order signals, etc., Thomas A. Edison, Inc., in collaboration with the Edison Lamp Works of the General Electric Company, has recently developed a special bulb for switch lamp lighting to be operated from four Edison primary cells that is said to project a beam of light more intense than that of the present oil lamp and more reliable than the oil lamp, and at the same time effect marked economies in the maintenance of switch lamps. To convert the old oil switch lamp into an electric lamp, the oil fount is removed and an adapter is mounted in the lamp. The filament of the lamps is highly concentrated, so it is essential that the lamp be so mounted as to bring its filament in the exact focal center. This is accomplished by the use of the adapter, together with a focusing device that is provided with it.

In the design of the electric light bulb, it was necessary to keep the current consumption down to a minimum and at the same time provide sufficient candle power to give the required projected beams. By concentrating the filament and producing an intense light in one spot, and placing that intense spot of light in the exact focal area of the optical lens, the maximum efficiency is obtained in the projected beam. The application of this principle made it possible to use an electric bulb having less spherical candlepower than the flame of an oil lamp, but which was capable of projecting through an optical lens a beam of more candlepower than could be derived from the oil lamp flame. By keeping the spherical candlepower down to a minimum, it requires a small amount of electrical energy to pro-



An Electric Lighted Switch Lamp on the Great Northern

duce a light that would give greater beam candlepower than the present oil lamp.

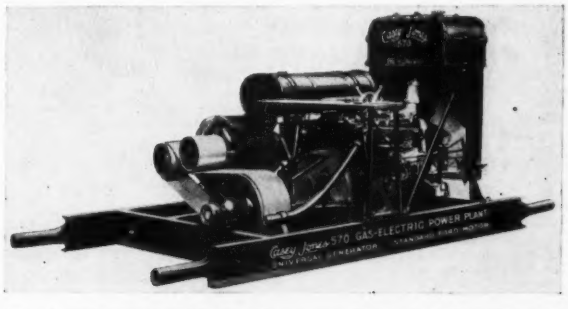
The Edison primary cells which furnish the electrical energy for the operation of this lamp are the same as those used in the operation of signal apparatus. These cells require no attention until they are renewed. They operate on this service at any temperature as the solution is non-freezing. No expert knowledge is required in their maintenance. At the expiration of six months the electrodes of the cell are renewed at a net cost of approximately $1 per cell or $4 for the four-cell battery. It is also recommended that the electric bulb be replaced each time the electrodes of the battery are renewed, as a precaution against burning out the lamp while in service. The cost of these special lamp bulbs is 45 cents each, or a total cost of $9 per year for material necessary for the operation of an electric lighted switch lamp, while the only labor necessary is one or two hours work every six months in renewing the electric bulbs and electrodes of the cells.

While the reported cost of maintaining oil lamps per year shows a wide variation on different railroads, a recent canvass of practically all of the large railroads in this country indicates that the average cost per year of maintaining an oil-lighted switch lamp (labor and material) approximates $20. On that basis, the adoption of primary battery-operated electric switch lamps presents opportunities for effecting marked economy in their maintenance.

Outside of the fact that electric lighting eliminates the troublesome features involved in the maintenance of oil lamps, other advantages in the use of electric lights are emphasized, among which are the facts that each switch lamp has a power plant of its own in the form of four cells of primary battery, insuring freedom from the effects of wind, storms, temperature, etc.; the light cannot blow out; it will not fail because of contaminated oil, improper maintenance, encrusted wicks, door left open, etc.; and it cannot be jarred out by a passing train. The maintenance labor required for battery-operated electric lighted switch lamps is not necessarily skilled since all it involves is renewing the electrodes of the battery every six months and replacing the lamps.

A New Gas-Electric Power Plant

THE Northwestern Motor Company, Eau Claire, Wis., has developed and placed on the market a new gas-electric power plant, designated as its Type 570, to supersede the Casey Jones 550 EP gas-electric



The Northwestern Motor Company Type 570 Gas Electric Power Plant

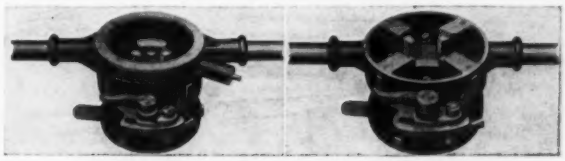
power car. This new unit is designed for more convenient handling than was possible with the former unit and can be loaded on an ordinary push car for moving. The unit is mounted complete on an all-steel underframe constructed of 6-in. riveted steel channels and is provided with convenient lifting handles at each end.

The generator is of the Universal type, with a capacity of 7½ kw., driven by a standard 20-hp. Ford motor, equipped with a water circulating pump, governor and special capacity radiator. The motor operates at a speed of 1,000 r.p.m. and the generator at 1,800 r.p.m. The power generated is capable of operating 10 electric tampers, 10 track saws, 10 track drills or the equivalent in other electric tools.

The use of standardized parts in this unit tends to low cost of maintenance and service since parts for the Ford motor can be obtained quickly and at small cost from any Ford service station. In service this power plant is said to have demonstrated marked efficiency with low operating costs.

New Adjustable Die Stocks

THE BORDEN Company, Warren, Ohio, has placed on the market a new series of adjustable die stocks which it designates as the No. 70 series Beaver, in which the die-adjusting cams are underneath the dies, thus eliminating all obstructions above and around the dies and leaving the full width of the dies exposed above the body of the tool to permit the free application of oil directly to the dies. As the life of the dies depends largely upon their proper lubrication, this arrangement promotes economy by insuring



Rachet Type **Plain Type**

Beaver Adjustable Die Stocks

that the oil may be applied where it is required and that no more than the proper amount need be used. This construction provides a solid wall back of the throats of the dies, reducing the tendency of the dies to tip when engaging the pipe and causes them to take hold and start easily. It also provides a free clearance around the dies for all sizes of pipe, preventing the accumulation of chips within the stock.

The construction of the cam consists of two main parts, a die head and a body casting between which the cam is located, the arrangement being shown in the accompanying illustrations. The cam is tapered and forms part of the locking device which consists of a short lever under the right-hand side of the cam. The operation of this lever clamps the cam firmly in its desired position, the tapered section of the cam resisting any tendency to slip under the strains of threading. The locking device is simple and may be adjusted easily and quickly. A lever mounted above the cam opens the dies sufficiently to clear the pipe, thus saving the time necessary to back them off the finished thread, as well as possible injury due to such an operation. The dies may be changed quickly without removing any other parts and without the aid of tools. A three-jaw universal chuck centers all sizes of pipe quickly and accurately. Jointed handles are used, reducing the size of the shipping box for 2-in. die stocks to 8 in. by 8 in. by 12¾ in., and other sizes in proportion. These tools may be furnished in either the plain or ratchet types, as desired, with threading ranges from ¼ in. to 2 in.

With the Associations

Maintenance of Way Club of Chicago

The Maintenance of Way Club will hold its sixth annual meeting and dinner on Wednesday evening, October 20, at the Auditorium hotel, Chicago. The attendance at the annual dinner of 1925 was 166, and an equal or larger number are expected to be present this year.

The American Railway Engineering Association

Seven committees held meetings during the last month, including those on Grade Crossing Design, Protection and Elimination at Chicago on September 10; Buildings at Quebec, Que., and Electricity at New York on September 15; Economics of Railway Location at Chicago on September 16; Track at Chicago on September 21; Records and Accounts at Chicago on September 24, and Economics of Railway Operation at New York on September 30.

The proceedings of the 1926 convention have come from the printer and are being distributed to the members. Three bulletins containing revisions of the manual are now in the hands of the printer.

Bridge and Building Association

In addition to the program published in the September issue, page 371, W. D. Faucette, chief engineer of the Seaboard Air Line, will present a paper on Wednesday afternoon. In a special session on Tuesday evening Thomas H. Carrow, supervisor of safety, insurance department, Pennsylvania Railroad, and chairman of the Safety Section of the American Railway Association, will present an address dealing with accident prevention in the bridge and building department.

A special train will leave Chicago at 12:45 Sunday afternoon, October 10, over the Cleveland, Cincinnati, Chicago & St. Louis for Richmond, Va., arriving in Cincinnati early that evening and leaving at midnight, reaching Richmond late Monday afternoon. Sleepers from Detroit will connect with this train at Cincinnati and additional sleepers will be added at the latter point.

Immediately after the adjournment of the convention, a special train will convey the members of the association and their guests to Norfolk where a trip has been arranged to view the coal dumpers and other facilities in the harbor at that point, the train returning to Richmond late that evening.

ROAD TO BE SOLD.—The Federal Court at Chicago has ordered the sale of the Chicago, Milwaukee & St. Paul at Butte, Mont., on November 22, and has placed the upset price at $122,500,000.

The Material Market

THE ACTIVE season of rail buying is now at hand and the inquiries received by the manufacturers from the railroads indicate that rail purchases will substantially equal those of the preceding years. The largest rail order thus far in prospect is that of the Pennsylvania which has already ordered 40,000 tons of rail and has inquiries out for 160,000 tons in addition. Recent inquiries for rail fastenings and other track supplies are in large volume and there is also an increasing movement toward the purchase of other railroad requirements, including equipment and structural material used in the repair and construction of cars.

However, the day seems past when a change in the volume of buying has any particular effect on the market with respect to prices, arrangements for delivery, and the like. As indicated in the table below, prices have been subject to no changes during the month.

PRICES PER 100 LBS.

	August		September	
	Pittsburgh	Chicago	Pittsburgh	Chicago
Track spikes	$2.80 to $2.90	$2.90	$2.80 to $2.90	$2.90
Track bolts	3.90 to 4.25	3.90	3.90 to 4.25	3.90
Angle bars	2.75	2.75	2.75	2.75
Tie plates, steel	2.75	2.75	2.25 to 2.35	2.35
Boat spikes	3.25	3.25	3.25	3.25
Plain wire	2.50	2.55	2.50	2.55
Wire nails, keg	2.65	2.70	2.65	2.70
Barb wire, galv.	3.35	3.40	3.35	3.40
C. I. pipe, 6 in. 12 in., ton	47.80 to 50.20		47.20 to 49.20	
Plates	1.90	2.10	1.90	2.10
Shapes	2.00	2.10	2.00 to 2.10	2.10
Bars, soft steel	2.00 to 2.10	2.10	2.00 to 2.10	2.10
Rivets, struct	2.50 to 2.60	2.65 to 2.75	2.50 to 2.60	2.70
Conc. bars, billet	2.00 to 2.10		2.00 to 2.10	
Conc. bars, rail	1.80 to 1.90	2.00	1.80 to 1.90	2.00
Rail, per gross ton, f.o.b., mills		43.00		43.00

The table of scrap prices given below shows that quotations at the end of September were substantially the same as those at the end of August. There appears to be little prospect of any change in the near future.

PER GROSS TON

	August	September
Relaying rails	$26.00 to $31.00	$26.00 to $31.00
Rails for rerolling	17.00 " 17.50	17.50 " 18.00
Rails less than 3 ft. long	17.50 " 18.00	17.50 " 18.00
Frogs and switches cut apart	16.00 " 16.50	16.00 " 16.50
Steel angle bars	16.25 " 16.75	16.25 " 16.75

Taken as a whole, the lumber market is in a stable condition, presenting substantially the same relation between sales and production as during preceding months of the year. September prices varied so little from those of the preceding month as to preclude any prospect of a marked change in the near future.

SOUTHERN PINE MILL PRICES

	August	September
Flooring, 1x4, B and B flat	$44.53	$44.39
Boards, 1x8, No. 1	36.27	37.90
Dimension, 2x4, 16, No. 1, common	28.29	28.45
Dimension, 2x10, No. 1, common	30.06	29.94
Timbers, 4x4 to 8x8, No. 1	28.31	29.24
Timbers, 3x12 to 12x12, rough	42.06	43.67

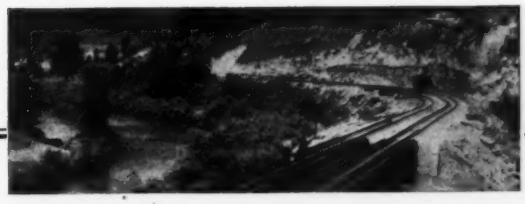
DOUGLAS FIR MILL PRICES

Flooring, 1x4, No. 2, clear, flat	$27.00	$27.00
Boards, 1x8, 6 to 20, No. 1, common	16.00	16.00
Dimension, 2x4, No. 1, common	17.00	17.00
Dimension, 2x10, 16, No. 1, common	17.00	17.00
Timbers, 6x6 to 8x8, No. 1	20.00	20.00
Timbers, 3x12 to 12x12, rough	18.00	18.00

The prices for Portland cement given in the table below, which are per barrel in carload lots not including packing, are exactly the same as those given in the same table in last month's issue.

New York	$2.15	Minneapolis	$2.32
Pittsburgh	2.09	Denver	2.85
New Orleans	2.30	Dallas	2.05
Chicago	2.16	San Francisco	2.31
Cincinnati	2.37	Montreal	1.15

Railway News Briefly Told



The St. Louis-San Francisco operated 5,008 of its 5,167 passenger trains on time during the month of July, making an on-time percentage of 96.9 as compared with 95.3 per cent for the same month in 1925.

The Southern Pacific installed 70 radio sets in various isolated construction camps along the line of its recently completed Natron Cut-off in Oregon and California, each camp having from one to eight sets. The instruments were provided as a means of keeping the workmen contented.

The Pennsylvania announces that the establishment of a "New Ideas Bureau" is contemplated and invites all employees of the system to send in suggestions as to how the new bureau should be organized and what it should do. A prize of $50 will be awarded for the best plan presented from each of the three regions of the road.

Net railway operating income of Class I railroads for July was $116,895,311, at the rate of 5.62 per cent on the property investment, as compared with 4.90 per cent in July of last year. For seven months the net operating income was $611,853,632; at the rate of 5.06 per cent as compared with 4.56 per cent for the same period in 1925.

The Southern has moved a total of 10,870 cars of peaches from Georgia since May 23, or more than 3,000 cars above any former record, and a heavy watermelon crop has been moved at the same time. The Southern also moved 1,677 cars of peaches from East Tennessee, 1,251 cars from North Carolina, and 242 cars from other places, making a total movement of 14,040 cars of peaches.

The week beginning October 3 has been designated as the annual fire prevention week in the United States. The Railroad Insurance Association, in an appeal which it is circulating among the railroads, stresses the importance of taking careful note of the past, calling attention to the fact that there were 8,609 railroad fires in 1924, and that the nation's fire waste in 1925 amounted to $570,225,921.

A pension system has been organized for old employees of the Spokane, Portland & Seattle and its subsidiaries which provides that employees 70 years of age who have been in the service of the company continuously for 20 years will be retired on pension. The amounts will be based on the average salaries for the 10 years immediately preceding retirement with length of service as a factor.

The Romney Hythe & Dymchurch light railway under construction on the southeast coast of England is approaching completion. The line is about eight miles long and is notable by reason of its narrow gage, 15 in., and its Pacific type engines, which are exact replicas, one-third size of the standard 4-6-2 engines in use in England. These locomotives have cylinders 5¼ in. by 8½ in, and driving wheels 25½ in. in diameter, while the total length of the locomotive and tender is 25 ft. The engines weigh about eight tons. In addition two engines of the 4-8-2 type are being built as well as one of the 0-4-0 type for switching. The passenger cars are semi-open and carry eight persons each.

The Public Service Commission of New York announces that 13 additional projects for the elimination of grade crossings have been abandoned for the present because of the provision of the law forbidding action where the prospective financial burden on a city, town or village is beyond certain specified limits. These abandoned projects are on the New York, Ontario & Western; the Boston & Albany; the New York Central; the Lackawanna; the Lehigh Valley; the Ulster & Delaware; and the Buffalo, Rochester & Pittsburgh. In each case opportunity was given to submit the proposition to the voters but the authorities declined to do so. In each case the county would not aid the town.

What is believed to be a new world record in the driving of railroad tunnels was completed during the month of August in the eight-mile Cascade tunnel of the Great Northern when the pioneer drift 8 ft. high by 9 ft. wide was advanced 937 ft. in working on one face only. This record of A. Guthrie & Co., the contractors of this tunnel, is compared with a record of 932 ft. made in a heading of smaller section in the pioneer drift of the Rogers Pass tunnel on the Canadian Pacific in January, 1915.

The Supreme Court of Michigan holds that although a railroad is bound, where a winding road and bridge crosses its tracks, to erect a fence or barrier at the turn of the road on the approach to the bridge to warn travelers of its dangers, it is not bound to erect a barrier that will withstand the impact of an automobile. The driver of an automobile which went through the railroad's railing on such a curved approach and over the embankment was held negligent under the law which requires a driver to keep his automobile under control at bridges and sharp curves.

Revenue freight car loadings for the week ended September 18 amounted to 1,187,011 cars, thus establishing a new high record and exceeding the previous high record in the week ended September 4 by 35,665 cars. It was also an increase of 155,930 cars over the preceding week, which contained the Labor Day holiday and an increase of 88,384 cars over the corresponding week of last year. The cumulative total for the first 38 weeks of this year is 38,068,949, as compared with 36,771,919 and 34,613,989 for the corresponding periods in 1925 and 1924, respectively.

The law of New York, known as the Kaufman Act, which requires the railroads to discontinue the use of steam locomotives within the limits of New York City has been declared unconstitutional by a decision handed down by Judges Learned Hand, John C. Knox and Thomas D. Thatcher. The court holds that the law would be a regulation of interstate commerce and would interfere with the proper exercise of such regulation by the federal government. The regulation of locomotives is a field in which Congress has already acted, as in the boiler inspection act and in parts of the safety appliance acts.

Heavy rains and storms in various parts of the country during September resulted in considerable damage to railroad property. Rainfall of from 5 to 6 inches on September 8 and 9 in central Illinois washed out embankments and flooded the tracks of the Wabash, the Baltimore & Ohio, and the Jacksonville & Havana, and on September 14 heavy rains in northeastern Missouri caused a number of washouts on the Chicago, Burlington & Quincy. A precipitation of from 5 to 7 inches occurred in western Iowa and southeastern South Dakota on September 18 and 19, washing out embankments and bridges on the Chicago & North Western, the Chicago, Rock Island & Pacific and the Chicago, Milwaukee & St. Paul. The damage to railroads in Florida by the hurricane of September 18 to 20 was not as great as the first general reports indicated, although the Louisville & Nashville suffered severely at and near Pensacola, where the roundhouse, shops, wharves and freight depot were badly damaged and approximately eight miles of main track was washed out between Pensacola and Escambia bay, with a loss of about $500,000.

Personal Mention

General

E. J. Allen, assistant superintendent of the creosoting plant of the Southern Pacific at Wilmington, Cal., has been promoted to superintendent of the same plant, succeeding **W. O. Spencer,** who has been transferred to the plant at West Oakland, Cal.

E. Kelly, superintendent of the treating plant of the Atchison, Topeka & Santa Fe, at Albuquerque, N. M., has been promoted to assistant manager of treating plants, with headquarters at Topeka, Kan., succeeding **S. D. Cooper,** deceased.

James P. Walker, who has been promoted to general superintendent of the Atlantic Coast Line, with headquarters at Savannah, Ga., was born on April 27, 1883, at Overfield, W. Va., and was educated at Washington and Lee University. He entered railway service in July, 1903, as a chainman on the Baltimore & Ohio, and was promoted successively to rodman, levelman and transitman. He entered the service of the Atlantic Coast Line in April, 1906, as a transitman and served successively as resident engineer, division engineer, assistant superintendent and then as superintendent, with headquarters at Charleston, S. C. On April 1, 1923, he was appointed superintendent of transportation, with headquarters at Jacksonville, Fla., which position he was holding at the time of his recent promotion. During the war Mr. Walker also served as terminal manager for the United States Railroad Administration.

C. W. Lentz, roadmaster on the Illinois Central, with headquarters at Mattoon, Ill., whose promotion to trainmaster, with headquarters at Palestine, Ill., was noted in the August issue, was born in 1878 at Wetaug, Ill., and entered railway service in 1896 as a section laborer at that place. He was later promoted to assistant section foreman and still later became a carpenter with the same road. He was promoted to carpenter foreman, serving in that capacity for a year and in 1905 became a concrete foreman, and thereafter served in 1906 as a bridge foreman; in 1907 as a pile driver foreman; in 1908 as a concrete foreman and in 1909 as general foreman of bridges and buildings, in which capacity he remained until 1913, when he was promoted to supervisor of bridges and buildings. In 1916 he was promoted to bridge inspector of the southern lines and in 1921 was promoted to chief building inspector. He was promoted to roadmaster at Mattoon in 1923, in which capacity he was serving at the time of his recent promotion.

J. J. Pelley, vice-president in charge of operation of the Illinois Central and formerly a roadmaster on that road, has been elected president of the Central of Georgia, with headquarters at Savannah, Ga., succeeding **Lawrence A. Downs,** whose election as president of the Illinois Central is noted in this column. Mr. Pelley was born on May 1, 1878, at Anna, Ill., and entered railway service as a track apprentice on the Carbondale division of the Illinois Central. He was promoted to supervisor on the Indiana division in 1904, and was transferred to the Memphis division in the following year. He was promoted to roadmaster on the Louisiana division in 1908 and was transferred to the Tennessee division in 1911. He was promoted to superintendent of the Tennessee division in 1912, and to general superintendent in 1917, when he withdrew temporarily from the service of the Illinois Central to engage in work with the Car Service Division of the American Railway Association, returning to the Illinois Central as general manager on April 1, 1923. He was elected vice-president in December, 1924, in which position he has continued until his recent election as president of the Central of Georgia.

Lawrence A. Downs, president of the Central of Georgia, with headquarters at Savannah, Ga., and an engineer by training, has been elected president of the Illinois Central, with headquarters at Chicago, succeeding **C. H. Markham,** who has been elected to the newly created position of chairman of the board and who relinquishes the presidency on account of ill-health. Mr. Downs was born at Greencastle, Ind., on May 9, 1872, and graduated from Purdue University in 1894. He entered railway service in the following year with the Vandalia (now a part of the Pennsylvania), and from March, 1896 to 1908, was in an engineering party on the Illinois Central, being promoted to roadmaster on the Amboy division in the latter year, and transferred successively to the Louisville, Springfield and Chicago divisions. He was promoted to assistant chief engineer maintenance of way in March, 1907, remaining in that position until December 6, 1910, when he was promoted to superintendent of the Kentucky division. On November 1, 1915, he was promoted to general superintendent of the lines south of the Ohio river, with headquarters at New Orleans, La. He was transferred to Chicago on August 1, 1917, as general superintendent of the Northern lines and in January, 1919, he was promoted to assistant general manager. Mr. Downs was appointed vice-president and general manager of the Central of Georgia, with headquarters at Savannah, Ga., on March 1, 1920, and this was followed by his election to the presidency on January 8, 1924.

Edward M. Durham, Jr., assistant to the president of the Missouri Pacific, with headquarters at St. Louis, Mo., has been promoted to the newly created position of vice-president of the Missouri Pacific, the Gulf Coast Lines and the International Great Northern, with the same headquarters. Mr. Durham was born on October 23, 1875, at Memphis, Tenn., and graduated from Lehigh University in 1896, after which he served from 1896 to 1897 with the War Department in a party which made a hydrographic survey of the Onachita river, and from 1897 to 1899 as a recorder for the deep waterways commission of the state of New York. He entered railway service in 1899 as a transitman with the Chicago & North Western and was made an assistant engineer on the Southern in 1900, from which time until 1920 he was promoted successively to resident engineer, principal assistant engineer, assistant chief engineer and chief engineer, of that road. His railway services during that time included two years as valuation engineer of the Atlanta, Birmingham & Atlanta and two years as executive general agent of the Southern. In 1920, he was appointed manager of the department of way and structures of the United States Railroad Administration, with headquarters at Washington, D. C. In November, 1923, he was made director of the division of liquidation claims in which capacity he served until 1924, when he was appointed assistant to the president of the Missouri Pacific, which position he held until his promotion to vice-president.

Edward M. Durham, Jr.

Changes on the Pennsylvania

Changes have been made on the Pennsylvania during the past month involving officers with engineering training and experience as follows: **Elisha Lee,** vice president in charge of operation, with headquarters at Philadelphia, Pa., has been appointed vice president, with the same headquarters, a newly created position, and **M. W. Clement,** assistant vice-president in charge of operation, has been promoted to succeed Mr. Lee. **R. V. Massey,** general manager of the Eastern region, with headquarters at Philadelphia, has been promoted to assistant vice-president in charge of personnel,

a newly created position, with the same headquarters. **C. I. Leiper,** assistant general manager of the Eastern Region, with headquarters at Philadelphia, has been promoted to general manager of the Central region, a newly created position, with headquarters at Pittsburgh, Pa., and **H. E. Newcomet,** general superintendent of the Lake Division, with headquarters at Cleveland, Ohio, has been promoted to the newly created position of general manager of the Western region, with headquarters at Chicago. **J. H. Redding,** superintendent of the Pittsburgh division, with headquarters at Pittsburgh, Pa., has been promoted to general superintendent of the Western Pennsylvania division, with the same headquarters. **R. C. Barnard,** superintendent of the Cincinnati division, with headquarters at Cincinnati, has been promoted to the newly created position of general agent and superintendent of the same division.

Mr. Clement was born at Sunbury, Pa., and was educated at Trinity College. He entered railway service on August 1, 1901, with the Pennsylvania in the engineering department and was promoted to assistant supervior on March 20, 1905, serving in this capacity and as supervisor until December 14, 1917, when he was promoted to division engineer. He was promoted to division superintendent on June 16, 1917, since which time he has served successfully as superintendent of freight transportation, superintendent of passenger transportation, general superintendent, and general manager of the Central region. He was promoted to assistant vice-president in charge of operation, with headquarters at Philadelphia, Pa., on October 1, 1925, and was holding that position at the time of his recent promotion to vice-president in charge of operation.

M. W. Clement

R. V. Massey

H. E. Newcomet

C. I. Leiper

Mr. Massey was born on September 29, 1871, at Dover, Del., and graduated from the Sheffield Scientific School of Yale University in 1892, entering railway service on September 1 of the same year in the construction department of the Pennsylvania, where he remained until August, 1925, when he was transferred to the maintenance of way department, in the office of the assistant engineer at Altoona, Pa. He was promoted to assistant supervisor in November of the same year, with headquarters at Freeport, Pa., being transferred to Baltimore in April, 1897, and to Miffin, Pa., in April, 1899. He was promoted to supervisor of the Schuylkill division in 1900, later serving in the same capacity with the Philadelphia, Baltimore & Washington (now a part of the Pennsylvania), and in 1905 was appointed supervisor of the Pittsburgh yard. In April, 1907, he was promoted to division engineer of the Schuylkill division and was transferred to the New York division on January 1, 1909. In March, 1911, he was promoted to superintendent of the New York, Philadelphia & Norfolk, and later was promoted successively to general superintendent and assistant general manager. He was promoted to general manager of the Eastern Region in 1923, which position he was holding at the time of his recent promotion to assistant vice president.

Mr. Newcomet was born on April 27, 1874, at Philadelphia, Pa., and graduated from the University of Pennsylvania in 1894. He entered railway service in 1896 as an assistant on the engineering corps on the Chicago division of the Pennsylvania, being promoted to acting assistant engineer on the Cleveland & Pittsburgh division in 1897, and to assistant engineer maintenance of way on the Cincinnati division in 1898. In June, 1901, he was promoted to engineer maintenance of way on the Indianapolis and Vincennes division, being transferred to the Cincinnati division on January 15, 1903, and to the Erie and Ashtabula division in March, 1905. He was promoted to division engineer of the Cleveland and Pittsburgh division in 1906, and to superintendent of the Louisville division in January, 1913. He was promoted to general superintendent of the Lake division in 1923, and was holding that position at the time of his recent promotion to general manager of the Western region.

Mr. Leiper was born at Wallingford, Pa., on October 28, 1874, and graduated from Swarthmore College in 1895, later taking a special course at the University of Pennsylvania. He entered railway service in 1897 in the construction department of the Pennsylvania and was promoted to transitman at Altoona in February, 1901, and to assistant supervisor on the Maryland division in March of the same year. He was promoted to supervisor of the same division in 1903 and was later transferred successively to the Pittsburgh and the New York divisions. In August, 1909, he was promoted to division engineer of the Manhattan division and in 1911 was transferred to the New York division. He was appointed principal assistant engineer of the Philadelphia, Baltimore & Washington (now a part of the Pennsylvania), on June 16, 1913, and in February, 1914, was appointed superintendent of the New York, Philadelphia & Norfolk, later serving as superintendent and general superintendent on the Pennsylvania. He was promoted to assistant general manager of the Eastern Region in October, 1923, and was holding that position at the time of his recent promotion to general manager.

Mr. Redding was born on November 26, 1877, at Philadelphia, Pa., and entered railway service on May 1, 1897, in the office of chief engineer maintenance of way of the Pennsylvania, being promoted successively to assistant supervisor, supervisor, division engineer, assistant superintendent and superintendent. He was superintendent of the Pittsburgh division at the time of his recent promotion to general superintendent.

Mr. Barnard was born on February 5, 1869, at Montreal, Que., and was educated at Worcester Polytechnic Institute. He entered railway service as an assistant on an engineering corps on the Pennsylvania in 1890 and in 1895 was promoted to assistant engineer on the Chicago division of the Pittsburgh, Cincinnati, Chicago & St. Louis (now a part of the Pennsylvania). He was promoted to engineer maintenance of way of the Richmond division in July, 1898, and was transferred to the Cincinnati division in April, 1900. He was promoted to superintendent in 1902, which position he was holding at Cincinnati at the time of his recent promotion. He also served as secretary of the Dayton Union from 1911 to 1918.

Engineering

H. J. Bogardus has been appointed division engineer on the Pt. Huron-Grand Rapids division of the Pere Marquette, succeeding **J. E. Johnson,** deceased.

T. C. McNabb, superintendent on the Canadian Pacific, with headquarters at Revelstoke, B. C., has been appointed engineer on construction, with headquarters at Winnipeg, Man.

R. M. Smith, division engineer of the Central division of the Missouri Pacific, with headquarters at Van Buren, Ark., has been transferred to the Memphis division, with headquarters at Wynne, Ark., succeeding R. H. Hallsted, who has been transferred to the Central division.

Arthur F. Gayfer, division engineer of construction and locating engineer on the Canadian National, has been appointed division engineer of the Melville division, with headquarters at Melville, Sask., succeeding **W. Waters,** who was temporarily relieving **G. Murray,** who is on leave of absence.

J. R. Schick, engineer of branch lines on the Norfolk & Western, with headquarters at Roanoke, Va., whose retirement was noted in the September issue, was born on July 30, 1856, at Easton, Pa., and was educated at Lafayette college from which he graduated in 1876. Following three years of surveying and architectural work he entered the service of the Pennsylvania as a draftsman in the chief engineer's office in 1879, with headquarters at Philadelphia, Pa. On July 1, 1881, he went to the Norfolk & Western as chief draftsman, with headquarters at Roanoke, and was promoted to assistant engineer on July 16, 1899. On March 1, 1904, he was made engineer of branch lines, which position he held until his recent retirement.

J. H. Babbitt, whose promotion to assistant division engineer on the Baltimore & Ohio, with headquarters at Washington, Ind., was noted in the September issue, was born on July 24, 1894, at Northampton, Mass., and was educated at the Massachusetts Institute of Technology. He entered railway service in June, 1917, as an assistant on an engineering corps on the Pennsylvania, later serving for almost two years in the army and for nine months as construction engineer for the Miller Rubber Company, Akron, Ohio. Mr. Babbitt entered the service of the Baltimore & Ohio in March, 1921, as an assistant on an engineering corps at New Castle, Pa., and has been connected with the company ever since in that capacity and as assistant supervisor or acting supervisor, until his recent promotion.

H. B. Pilcher, assistant engineer on the Wabash, with headquarters at Adrian, Mich., has been promoted to division engineer, with headquarters at Springfield, Ill., succeeding **A. F. Gardner,** who has been transferred to Moberly, Mo., to replace **H. N. Huntsman,** who has resigned. **N. E. Potter,** track supervisor with headquarters at St. Louis, Mo., has been promoted to assistant engineer, with headquarters at Decatur, Ill., succeeding **C. A. Johnson,** who has been transferred to Adrian, Mich., in place of Mr. Pilcher. **O. A. Lewis,** supervisor bridges and buildings, with headquarters at Montpelier, Ohio, has been promoted to assistant engineer, with headquarters at Moberly, Mo., succeeding **H. B. Holloway,** who has been appointed track supervisor, with headquarters at St. Louis, Mo., to replace Mr. Potter.

T. P. O'Neill, assistant engineer maintenance of way on the Chicago, Burlington & Quincy, with headquarters at Alliance, Neb., whose appointment as engineer maintenance of way on the Colorado & Southern was noted in the September issue, was born on April 20, 1883, at St. Catherine, Mo., and was educated at Christian Brothers College at St. Louis, Mo. Prior to attending college he had entered railway service as a section laborer on the Chicago, Burlington & Quincy in 1899, in which position he served for four years. He was employed in the engineering department of the Burlington from 1906 to 1910, and in the engineering department of the Kansas City Terminal from 1911 to 1914. He was assistant engineer for the Wyandotte Construction Company in 1915, re-entering railway service as an instrumentman on the Kansas City Southern in 1916. Later in the same year he was made an assistant engineer on the Chicago, Burlington & Quincy, remaining in that position until 1921, when he was appointed roadmaster on the Kansas, Oklahoma & Gulf. He was appointed assistant engineer maintenance of way on the Burlington in 1923 and was occupying that position at the time of his recent appointment.

A. Chinn, roadmaster on the Chicago, Burlington & Quincy, with headquarters at Kansas City, Mo., whose promotion to assistant engineer maintenance of way, with headquarters at Alliance, Neb., was noted in the September issue, was born on September 26, 1894, at Dallas, Tex., and was educated at the Virginia Polytechnic Institute where he graduated in 1916. He entered railway service in June of the same year as an instrumentman on the Chicago, Burlington & Quincy on track elevation at Aurora, Ill., and has been with that company continuously with the exception of 1918 and 1919 when he was second lieutenant in the Field Artillery of the A. E. F. in France. After leaving the army he re-entered the service of the Burlington as an instrumentman and was located at LaCrosse, Wis., and Centralia, Ill., on yard construction from 1919 to 1921, being promoted to assistant engineer in 1922, with headquarters at Aurora, Ill. During 1923 and 1924 he was division engineer and roadmaster on the Quincy, Omaha & Kansas City, a subsidiary of the Burlington. In 1925 he was appointed a roadmaster on the Burlington, with headquarters at Kansas City, which position he was holding at the time of his recent promotion.

I. W. Geer, assistant general manager of the Western region of the Pennsylvania, with headquarters at Chicago, has been promoted to assistant chief engineer, with the same headquarters. Mr. Geer was born on February 1, 1873, at Plainfield, Conn., and graduated from Yale University in 1895. He entered railway service in the same year on the Pennsylvania as a rodman on the chief engineer's staff, being promoted to assistant in an engineering corps on the Erie and Ashtabula division in 1897. He was promoted to assistant engineer in 1898, and to engineer maintenance of way on the same division in 1901, and was transferred to the Pittsburgh division in 1902. During 1904, he served as superintendent of the Terre Haute & Logansport and the Logansport & Toledo (now parts of the Pennsylvania) and during the next two years he was superintendent of the Michigan division of the Vanadlia (now a part of the Pennsylvania). In 1906, he was appointed superintendent of the Logansport division of the Pittsburgh, Cincinnati, Chicago & St. Louis (now a part of the Pennsylvania) and in 1913, he was appointed superintendent of the Cleveland and Pittsburgh division of the Pennsylvania, with headquarters at Cleveland, Ohio. In 1915, he was promoted to general superintendent of the Central sytem and in 1917 was transferred to the Southwest system. In 1920, he was promoted to general manager of the Southwestern region and in 1925, with the consolidation of the Northwestern and the Southwestern regions he was appointed assistant general manager of the Western region, which position he was holding at the time of his recent promotion.

I. W. Geer

Merritt A. H. Scull, whose promotion to assistant engineer maintenance of way on the Central Railroad of New Jersey, with headquarters at Jersey City, N. J., was noted in the September issue, was born on April 10, 1892, at Philadelphia, Pa., and graduated from the University of Penn-

sylvania in 1912. Entering railroad service the same year as a rodman in the chief engineer's office of the Reading Company, he was promoted to assistant supervisor at Tamaqua, Pa., in 1913, and at subsequent dates was transferred to Reading and Lansdale, Pa., respectively. In 1916 he was connected with the valuation department as bridge and building pilot, and in September, 1917, left the Reading Company to enter military service as a private in the 304th ammunition train at Camp Meade, Md. He was subsequently promoted to second lieutenant in the engineering corps and in March, 1918, went overseas with the railroad transporation corps, where he served as trainmaster on the lines between Nevers and Is-sur-Tille in France. He was promoted to first lieutenant in 1918 and appointed on the Inter-Allied Railway Commission at Saarbrucken, Germany. After serving in Poland with the Polish Typhus Relief Expedition he returned to the United States and re-entered the service of the Reading as supervisor at Reading in January, 1920. In May of the same year he entered the service of the Central Railroad of New Jersey as assistant supervisor and in February, 1923, was promoted to supervisor, with headquarters at Ashley, Pa., which position he held at the time of his recent promotion.

Track

L. G. Signell, assistant on an engineering corps on the Pennsylvania, has been promoted to assistant supervisor, with headquarters at Ft. Wayne, Ind.

L. V. Lienhard has been appointed acting roadmaster on the Colorado division of the Atchison, Topeka & Santa Fe, with headquarters at Pueblo, Colo., succeeding **T. A. Blair,** who has been assigned temporarily to other duties.

Alex Lee, section foreman on the Temiskaming & Northern Ontario at Englehart, Ont., has been promoted to roadmaster, with the same headquarters, succeeding **R. Killins,** who has been transferred to Porquis, Ont., where he succeeds **L. Keller,** who has left the service.

W. C. Morris, assistant engineer on the Southern, with headquarters at St. Louis, Mo., whose promotion to track supervisor, with headquarters at Lawrenceburg, Ky., was noted in the September issue, was born on September 24, 1892, at Quinton Ala. and was educated at the Alabama Polytechnic Institute. He entered railway service on May 1, 1924, as an assistant engineer on the Southern and was holding that position at the time of his recent promotion.

C. F. Allen has been appointed roadmaster of the C. & M. division of the Chicago, Milwaukee & St. Paul, with headquarters at Milwaukee, Wis., succeeding **C. A. Drawheim,** who has been appointed general foreman of the rail laying gang on the Northern district. **A. J. Barber** has been appointed roadmaster of the R. & S. W. division, with headquarters at Beloit, Wis., succeeding **J. Gould,** who has been appointed general foreman of the rail laying gang on the Lines West of Mobridge.

A. H. Nichols, supervisor of bridges and buildings on the Mobile & Ohio, with headquarters at Tuscaloosa, Ala., has been promoted to roadmaster, with the same headquarters, succeeding **F. W. Kahlmus,** transferred to the Mobile division, with headquarters at Meridian, Miss., where he relieved **J. Mulvoy,** who has been appointed track supervisor at Tuscaloosa, in place of **V. C. Hanna,** whose promotion to supervisor of bridges and buildings is noted elsewhere in this issue.

Martin H. Williams, whose promotion to district roadmaster on the Willmar division of the Great Northern, with headquarters at Rutland, N. D., was noted in the September issue, was born on August 11, 1892, at Ashland, Wis., and was educated at the University of Wisconsin. He entered railway service in June, 1915, as a rodman on the Great Northern. He enlisted as a second class private in the 6th Regiment, Engineers (later the 16th Regiment, Engineers) in May, 1917, and served 21 months overseas in the World War, being discharged in May, 1919, as first lieutenant. He re-entered the service of the Great Northern as a roadmaster's clerk at Sioux City, Iowa, and was promoted to roadmaster a year later. After serving as roadmaster for five months he became foreman in the yard at Sioux City, where he remained until his recent promotion except for periods in 1924 and 1925 when he was in charge of extra gangs relaying rail.

Homer Pryor, whose promotion to supervisor on the Pennsylvania, with headquarters at Spencer, Ind., was noted in the August issue, was born on October 21, 1888, at Newark, Ind., and entered railway service on August 15, 1909, as a trackman on the Pennsylvania at Worthington, Ind. He was promoted to section foreman at Spencer, Ind., on May 1, 1913, and served as section and extra gang foreman until June 1, 1926, when he was promoted to assistant supervisor, which position he was holding at the time of his recent promotion.

Albin Wahlgren has been appointed district roadmaster on the Fifth district of the St. Cloud division on the Great Northern, with headquarters at Park Rapids, Minn., succeeding **J. Lukoski,** who has been transferred to the Third district of the same division, to replace **F. J. Heinen,** who has been assigned to other duties. **F. G. Krona,** district roadmaster on the Third district of the Montana division, with headquarters at Havre, Mont., has been transferred to the Second division of the Kalispell division, with headquarters at Whitefish, Mont., where he relieved **Charles Johnson,** who has been transferred to Havre to replace Mr. Krona.

N. M. Gamble has been appointed track supervisor on the Wabash, with headquarters at Montpelier, Ohio, succeeding **J. S. Gamble,** who has been transferred to Moberly, Mo., to relieve **P. D. Hartman,** who has been transferred to Brunswick, Mo., to replace **W. R. Gee,** transferred to Stanberry, Mo., where he succeeds **L. Lucas,** who has been assigned to other duties. **H. B. Holloway,** assistant engineer, with headquarters at Moberly, Mo., has been appointed track supervisor, with headquarters at St. Louis, Mo., to succeed **N. E. Potter,** whose appointment as assistant engineer, with headquarters at Decatur, Ill., is noted elsewhere in this issue.

J. W. Rementer, whose appointment as supervisor on the Central of New Jersey, with headquarters at Ashley, Pa., was reported in the September issue, was born on October 7, 1886, at Philadelphia, Pa., and graduated from Drexel Institute in 1908. Immediately upon completing his education he entered the service of the Reading as a rodman on construction. At subsequent dates he was promoted to levelman, transitman and assistant engineer on construction work of the Reading, and later, assistant supervisor at Reading and at Pottstown, Pa., in which capacity he was serving at the time of his recent appointment as supervisor on the Central of New Jersey.

Bridges and Buildings

A. D. Gillis, district foreman on the New York, New Haven & Hartford, with headquarters at Providence, R. I., has been promoted to supervisor of bridges and buildings, with the same headquarters.

G. M. Johnson has been appointed supervisor bridges and buildings on the Wabash, with headquarters at Montpelier, Ohio, succeeding **O. A. Lewis,** whose promotion to assistant engineer is noted elsewhere in this issue.

Lloyd Castagneto, whose promotion to supervisor of bridges and buildings on the Oregon Short Line unit of the Union Pacific, with headquarters at Nampa, Idaho, was noted in the August issue, entered the service of the Oregon Short Line in 1914 as a carpenter at Pocatello, Idaho, and in June, 1917, was transferred to Nampa as a traveling carpenter. He was promoted to bridge and building foreman on August 1, 1922, in which position he was serving at the time of his recent promotion.

E. H. Nutt, whose promotion to supervisor bridges and buildings on the Cincinnati, New Orleans & Texas Pacific, with headquarters at Lexington, Ky., was noted in the September issue, was born on August 15, 1883, at Enterprise, Miss., and entered railway service on August 2, 1902, as a carpenter on the New Orleans & Northeastern (now

a part of the Southern). He was promoted to bridge and building gang foreman on May 2, 1906, which position he was holding at the time of his recent promotion.

V. C. Hanna, supervisor of track on the Mobile & Ohio, with headquarters at Tuscaloosa, Ala., has been promoted to supervisor of bridges and buildings, with the same headquarters, succeeding **A. H. Nichols**, whose promotion to roadmaster is noted elsewhere in this issue.

Mr. Hanna was born on August 15, 1898, at Prescott, Ark., and was educated at Alabama Polytechnic Institute, from which he graduated in 1921. Entering the service of the Mobile & Ohio in May, 1923, as assistant engineer in charge of the construction of the shops and yards at Iselin, Tenn., he was promoted to supervisor of track on the Montgomery district in July, 1924. In May, 1925, he was promoted to special engineer in charge of the construction of the shops at Murphysboro, Ill., following which in September, 1925, he again became a supervisor of track, which position he held at the time of his recent promotion.

Purchasing and Stores

Arthur B. Clarke, of the stores department of the Canadian National at Moncton, N. B., has been promoted to acting storekeeper at Charlottetown, P. E. I., succeeding **R. MacDonald**, deceased.

R. J. Elliott, purchasing agent of the Northern Pacific, with headquarters at St. Paul, Minn., has been promoted to director of purchases, with the same headquarters, and has been succeeded by **C. C. Kyle**, general storekeeper, with headquarters at St. Paul.

T. J. Hegeman, sub-cost engineer on the staff of the vice-president in charge of operation of the Chicago, Burlington & Quincy, with headquarters at Chicago, has been promoted to superintendent of reclamation and scrap, a newly created position, with headquarters at Eola, Ill. **C. J. Mackie**, storekeeper, with headquarters at Aurora, Ill., has been promoted to traveling storekeeper, with headquarters at Chicago, succeeding **Hal D. Foster**, who has been transferred to the staff of the vice-president, to replace Mr. Hegeman. **C. H. Grometer** has been appointed storekeeper, with headquarters at Plattsmouth, Neb., to succeed **C. E. Swanson**, who has been transferred to Denver, Colo., replacing **G. A. Goerner**, who has been transferred to Aurora to succeed Mr. Mackie.

Obituary

Gen. Henry T. Douglass, at one time chief engineer of the Baltimore & Ohio, died on July 20 at the age of 88.

Thomas Connerton, supervisor on the Illinois Central, with headquarters at Cabery, Ill., was killed in a motor car accident near Anchor, Ill., on September 17.

J. E. Johnson, division engineer on the Pere Marquette, with headquarters at Saginaw, Mich., was killed in a motor car accident near Mosely, Mich., on September 8.

B. L. Bowers, roadmaster on the Kansas City Southern, with headquarters at Texarkana, Texas, died in Texarkana on August 11, after an illness of seven months. Mr. Bowers was born on November 28, 1879, in Missouri, and entered railway service on March 28, 1898, as a section laborer on the Chicago, Milwaukee & St. Paul, being promoted to section foreman on May 25, 1902. He later entered the service of the Union Pacific as a section foreman and was promoted to roadmaster on February 1, 1912. On July 1, 1913, he resigned his position as roadmaster, entering the train service where he remained for six months and then returned to the track department as a yard foreman. On April 1, 1914, he entered the service of the Kansas City Southern as yard foreman at Shreveport, La., and this was followed by his promotion to roadmaster, with headquarters at DeQuincy, La., on May 5, 1915. He was appointed general roadmaster of the Texas & Pacific, with headquarters at Marshall, Texas, in January, 1920, and returned to the Kansas City Southern on August 16, 1920, as roadmaster, with headquarters at Texarkana, Texas, which position he was holding at the time of his death.

William Hood, formerly chief engineer of the Southern Pacific, with headquarters at San Francisco, Cal., who retired in May, 1923, died in San Francisco on August 26, after a short illness. Mr. Hood was born on February 4, 1846, and was educated at Dartmouth College. He entered railway service in May, 1867, as a rodman on the Central Pacific, now a part of the Southern Pacific, and was promoted to assistant engineer in January, 1868. He entered the service of the Southern Pacific in June, 1872, and was promoted to chief assistant engineer in August, 1875. He served in a similar capacity on the Central Pacific from June to October, 1883, when he was promoted to chief engineer. Mr. Hood was made chief engineer of the Southern Pacific (Pacific System), in August, 1885, holding that position for more than a third of a century until his retirement. He had charge of most of the development of the Southern Pacific lines in the west, including the construction of the lines over the Siskiyou mountains in Oregon and over the Tehachapi mountains in California, both of these projects involving difficult engineering problems in securing operating grades through unusually rugged country.

William Hood

Trade Publications

Zeolite Water Softener.—The Graver Corporation has issued Bulletin No. 509, a 12-page pamphlet describing the Graver Zeolite water softener. The bulletin outlines the process and gives a complete description of the Graver equipment, supplemented by sectional illustrations and views of installations.

Spray Painting.—The Dunn Painting Machine Company, San Francisco, Cal., has just issued two four-page circulars outlining improvements which have been made in the Dunn spray painting machines. Data descriptive of the machines are given, together with the costs of painting with these machines, compared with other methods, on various kinds of work. The circulars are illustrated with views showing the details of the machines and their various applications.

Orton Cranes.—A 24-page bulletin has just been issued by the Orton Crane & Shovel Co., formerly the Orton & Steinbrenner Co., Chicago, dealing specifically with the Orton Models "T" and "E" Flexible Tread Convertible Cranes. This bulletin, No. 41, which is effectively illustrated, discusses in some detail the construction and the mechanical and operating features of these cranes, and the wide range of service to which they are said to be adapted.

Durable Douglas Fir.—A remarkably attractive bulletin of 32 pages has been issued by the West Coast Lumber Trade Extension Bureau, Seattle, Wash., presenting in popular form a description of Douglas fir lumber and a brief exposition of its application to various purposes. The bulletin is tastefully illustrated with photographs of the trees and with pictures illustrating the applications of the wood to various purposes.

"Let Blueprints Tell Your Story." In a bulletin gotten up in the style of a daily newspaper, the C. F. Pease Company outlined the results of a contest projected for the purpose of developing the best slogan for promoting the use of blueprints. In addition to the story of this contest which led to the selection of the slogan "Let Blueprints Tell Your Story," the various columns of this four-page newspaper contain many interesting stories concerning the value of blueprints for various purposes.

Construction News

The Atchison, Topeka & Santa Fe has awarded a contract to Sharp & Fellows, Los Angeles, Cal., for the construction of a 14-mile line from Porphyry, Cal., to Alberhill.

The Baltimore & Ohio has awarded a contract to the Vang Construction Company, Cumberland, Md., for grading, drainage and concrete arch work in connection with the extension of the Rossford yard near Toledo, Ohio, the entire project involving a total expenditure of approximately $1,000,000.

The Boston & Maine has awarded a contract to the American Bridge Company for an 800-ton steel bridge at Somerville, Mass. This company will extend and modernize its yard facilities at White River Junction, Vt., including the construction of a classification yard with more than double the present trackage. An expenditure of approximately $600,000 is involved. In addition the company plans a new passenger station for White River Junction.

Contracts have been awarded to the Dwight P. Robinson Company for the construction of a boiler shop as an addition to the locomotive repair plant at Billerica, Mass., and for the improvement and extension of a roundhouse at White River Junction, Vt. The boiler shop will be 572 ft. long, 150 ft. wide, and 50 ft. high over the middle aisle, and will be constructed of steel and brick at an estimated cost of $500,000.

The Chesapeake & Ohio awarded a contract to Joseph E. Nelson & Sons, Chicago, for the construction of a power house at Handley, W. Va., estimated to cost $50,000.

The Chicago & Eastern Illinois has awarded the general contract for the construction of engine terminal facilities at Evansville, Ind., involving a total expenditure of about $513,000, to G. A. Johnson & Son, Chicago. This project involves the construction of a 16-stall roundhouse, a powerhouse, a small machine shop, a 90-ft. continuous girder turntable, and a 400-ton coaling station.

The Chicago & North Western has awarded a contract to G. A. Johnson & Son, Chicago, for the construction of a one-story addition to the enginehouse and repair shop at Fremont, Neb., estimated to cost $35,000. A contract has been let to Joseph E. Nelson & Sons, Chicago, for the construction of a water treating plant including buildings, pipe lines and pumping machinery at New Ulm, Minn., estimated to cost $20,000.

The Chicago, Milwaukee & St. Paul has awarded contracts to Joseph E. Nelson & Sons, Chicago, for the construction of Koyl system water treating plants with capacity of 6,000 gallons per hour at Bird Island, Minn., Summit, South Dakota, and Bardwell and Hawarden, Iowa, and also for a 9,000 gallon per hour plant of the same design at Appleton, Minn., all of which are estimated to cost $95,000. A contract has also been let to the same company for the construction of a pumping station, water treating plant and fire protection facilities at Channing, Mich.

The Chicago, Rock Island & Pacific has awarded a contract to Joseph E. Nelson & Sons, Chicago, for the installation of two cinder conveyors at Rock Island, Ill., and also for the construction of a power house and a storehouse at Burr Oak (Chicago), which are estimated to cost $65,000.

The Erie has awarded a contract to the Arthur McMullen Company, New York, for grade crossing elimination at Ridgewood, N. J., estimated to cost $50,000.

The Grand Trunk Western has awarded a contract for grade separation at Kedzie avenue and Forty-ninth street, Chicago, to the Hamer, Paskins Company, Chicago. This work, involving an expenditure of $700,000, will carry eight tracks over the street and includes the construction of abutments and footings for five more.

The Jackson & Eastern has started the construction of the 40-mile extension of its line (a subsidiary of the Gulf, Mobile & Northern) from Lena, Miss., to Jackson, completing the original plans for a line from Union, Miss., to Jackson, 73 miles, connecting with the New Orleans Great Northern at the latter point. Bids are being received for the construction of a 190-ft. bridge across the Pearl river, east of Jackson. The 33-mile line already built from Union, Miss., to Lena, is undergoing grade reduction, construction of new trestles, and is being relaid with 85-lb. rail.

The Long Island has awarded contracts to the William F. Kenny Company for the construction of two steel and concrete bridges near Winfield, L. I., at an estimated cost of $500,000. Two additional bridges, one in Forest Park on the Montauk division, and another on the Rockaway Beach division, are now under construction, contracts having been awarded to Henry Steers, Inc. Another bridge over the Riverhead-Mattituck highway, eliminating a grade crossing at Broadway, Elmhurst, is now complete. This company has awarded a contract to Gibbs & Hill for the electrification of the Bay Ridge division, from Hell Gate bridge to Bay Ridge. The electrification plans include overhead trolley wires. The company is also installing double track from Lynbrook to Long Beach with company forces.

The Meridian & Bigbee River is receiving bids for the construction of a line 50 miles in length from Meridian, Miss., to Myrtlewood, Ala., at an estimated cost of $1,250,000. The line as projected will connect with the Southern, the Illinois Central, the Mobile & Ohio and the Gulf, Mobile & Northern at Meridian, with the Alabama, Tennessee & Northern at Cromwell, Ala., with the Sumter & Choctaw at Choctaw City, Ala., with the Tombigbee River barge line of the Inland Waterways at Naheola, Miss., and with the Louisville & Nashville at Myrtlewood.

The Nashville, Chattanooga & St. Louis will employ company forces in the rearrangement of the passenger station at Chattanooga, Tenn., at a total cost of $210,000. The work will involve track changes, remodeling of station building and adjacent structures, replacing the high truss train shed by umbrella sheds and renewing and extending the platforms.

The New Orleans Great Northern has been authorized by the Interstate Commerce Commission to construct an extension of its line from Nogan, Miss., to a site on the west bank of the Pearl river in Jackson, Miss., 6.65 miles, on condition that it allow the Gulf, Mobile & Northern and the Jackson & Eastern to operate over the proposed extension. The estimated cost of construction is $622,956.

The New York Central will make an expenditure of $5,000,000 over a period of two years to relocate and develop the West Shore railroad between South Schenectady and Selkirk. Work costing $2,155,000 is now being inaugurated. A third and fourth track will be added, and extensive grade reduction and relocation of track will be included in the program. The remaining $2,835,000 of the $5,000,000 will be spent in improving traffic facilities, including the construction of a large interchange yard between the West Shore and the Delaware & Hudson at Voorheesville.

This company is preparing to proceed with a $3,000,000 development program in Albany, including enlargement of the Union station and extension of upper level train sheds to the river front. The program calls for the enlargement of the Union station building, resulting in doubled capacity; the construction of an upper level yard extending from the station to the river front; the construction of a four-track approach to Maiden Lane bridge, replacing the present two track approach; the relocation of baggage rooms and concessions; and the installation of a new system of passageways.

The New York, Chicago & St. Louis, the holding company of the proposed Van Sweringen system, has renewed its application to the Interstate Commerce Commission for authority for the construction of a line from Valley Crossing to Gregg, Ohio, 63 miles, as a connecting link between the Chesapeake & Ohio and the Hocking Valley.

The Pennsylvania has awarded a contract to A. Guthrie & Co., Chicago, for the construction of a yard at Grogan near Columbus, Ohio. Other contracts have been awarded as follows: To the T. J. Foley Company, Pittsburgh, Pa., for grading, masonry, drainage and track work for the

extension of a passing siding at Broadacre, Ohio, at an estimated cost of $94,000; to the Ferguson & Edmonson Company, Pittsburgh, Pa., for similar work for the extension of a passing siding at Miller, Ohio, at an estimated cost of $78,000; to the Milliron Construction Company, Du Bois, Pa., for the reconstruction of the Mercer avenue bridge at Sharpsville, Pa., at an estimated cost of $57,000 and for the construction of an overhead bridge at Banport, Pa., at an estimated cost of $50,000.

This company has awarded other contracts totaling approximately $500,000 as follows: to Harvey Redden, Inc., Newark, N. J., for grading and track work in extending the Waverly classification yards, Newark, N. J., estimated cost, $36,000; to Kuhn, Smith & Harris, Inc., New York City, for the construction of office on mezzanine floor of Pennsylvania station, New York City; estimated cost, $39,000; to the Building & Industrial Construction Company, Pittsburgh, Pa., for grading foundations and superstructure for new tank shop at Altoona, Pa., estimated cost $310,000; to Kelly, Atkinson Construction Company, Chicago, for erection of superstructure of bridge over Tuscarawas river, Newcomerstown, O., estimated cost, $115,000. This company has awarded a contract to the Arundel Corporation, Baltimore, Md., by agreement with the Philadelphia Electric Power Company and the Susquehanna Power Company, for the relocation of the Columbia and Port Deposit branch from Fishing Creek, Pa., to Tome Institute, Md., a distance of 16 miles, at an estimated cost of $5,000,000. Contracts have also been awarded to the Coliami & Dire Company, Chicago, for grading and track work in connection with track elevation between 49th and 50th streets, Chicago, at an estimated cost of $60,000, and to the Milliron Construction Company, Dubois, Pa., for relocation of tracks to eliminate grade crossing between Renova and Keating, Pa., at an estimated cost of $65,000. Bids were closed on September 22 for a change of alignment over a distance of five miles at Collinsville, Ill. With rails and ties the cost is expected to approximate $1,000,000.

The Pere Marquette has awarded a contract to the Ferguson & Edmondson Company for grading and culvert construction for a new yard at Flint, Mich. This portion of the work is estimated to cost $200,000.

The Pittsburgh & Lake Erie has started the construction of a two-story freighthouse, 50 ft. by 150 ft., a yard with a capacity of 186 cars and a public delivery yard at Ellwood City, Pa., at a total estimated cost of $350,000.

The Reader has applied to the Interstate Commerce Commission for authority for the construction of a line from Hope to Eldorado, Ark., 63 miles, and also an extension from its present line in Nevada county to McNeill, Ark., 18 miles.

The St. Louis-San Francisco has been authorized by the Interstate Commerce Commission to construct an extension of 152 miles from Aberdeen, Miss., to Kimbrough, Ala., to afford an outlet, via the Muscle Shoals, Birmingham & Pensacola, to the Gulf of Mexico. A contract has been awarded to R. E. Carr, Memphis, Tenn., for the rehabilitation of the Muscle Shoals, Birmingham & Pensacola, at an estimated cost of $2,500,000.

The St. Louis Southwestern has awarded a contract to Bailey, Burns & Fitzpatrick, Texarkana, Ark., for the construction of a dormitory building at the Cotton Belt Hospital, Texarkana, at a cost of approximately $55,000.

The Southern Pacific has awarded a contract to the W. J. Harris Contracting Company, Houston, Tex., for the construction of a 17-mile extension from Edinburg, Tex., to Falfurrias.

The Union Pacific is preparing plans for the construction of a station at Gering, Neb.

The West Pittston-Exeter has been authorized by the Interstate Commerce Commission to construct a 4-mile line from a connection with the Delaware, Lackawanna & Western at Susquehanna avenue, West Pittston, Pa., to a point between the Sullivan highway and the Sesquehanna river. It is planned to electrify the line at some future date. Total cost, including electrification, is estimated at from $925,000 to $1,000,000.

Supply Trade News

General

The Wayne Tank & Pump Co., Fort Wayne, Ind., is preparing plans for a two-story plant, 62 ft. by 86 ft.

The Central Steel Company, Massillon, Ohio, and the **United Alloy Steel Corporation,** Canton, Ohio, have been consolidated under the new name of **Central Alloy Steel Corporation,** with headquarters at Canton, Ohio.

Personal

William C. Bergman, president of the Parsons Company, Newton, Iowa, died on August 23.

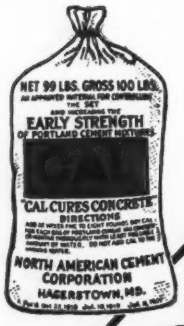
R. C. Simmons, formerly manager of the Seattle district of Johns-Manville, Incorporated, has been transferred to the New England territory, handling the railroad and United States Government work, effective September 13. Mr. Simmons will be associated with **C. D. Folsom,** at Johns-Manville, Incorporated, of Mass., 55 High street, Boston, Mass.

Claude F. Chard, for several years Cleveland district sales manager for the Austin Company, engineers and builders, Cleveland, Ohio, was instantly killed in an automobile accident near Medina, Ohio, on August 13. Mr. Chard graduated from Purdue University in 1910 and became associated with the Austin Company in 1918, having been with the Westinghouse-Church-Kerr Company in New York prior to that time.

Henry Robbins Wardell, a director and consultant on roofing and waterproofing material for Johns-Manville, Inc., New York, died on September 13, at Loon Lake, N. Y. He became identified with the Buffalo Pitts Road Roller Company, the Barber Asphalt Company, the Johns-Manville Company and the Central Commercial Company of Chicago, remaining in active business until three years ago when ill health caused him to relinquish some of his interest, although he served in an advisory capacity with the two last named companies until his death.

B. M. Cheney, president of Laughlin & Cheney, Inc., Chicago, sales agents for the Verona Tool Works, Pittsburgh, Pa., and other companies, has been appointed district sales manager for the Verona company with headquarters at Chicago, and the firm of Laughlin & Cheney, Inc., has been dissolved. Mr. Cheney was born on September 27, 1879, at Eldora, Iowa, and was educated at Iowa State College and Armour Institute, Chicago. He entered railway service in 1900 as an axeman on the Burlington, Cedar Rapids & Northern (now a part of the Chicago, Rock Island & Pacific), and in 1902 was appointed resident engineer on the Des Moines, Iowa Falls & Northern (now a part of the Rock Island), with headquarters at Des Moines, Iowa. In 1903 he became an instrumentman on the Illinois Central in southern Illinois. From 1904 to 1906 he was assistant engineer and chief engineer on the Interurban Railway at Des Moines, resigning to become assistant engineer on the Chicago, Burlington & Quincy, with headquarters at Beardstown, Ill. In 1910 he was transferred to Prairie du Chien, Wis., where he was in charge of second track construction, and in August, 1914, was promoted to general inspector permanent way and structures, resigning from this position in February, 1925, to organize Laughlin & Cheney, Inc., with which company he has been connected until his recent appointment.

Felt, one-half inch thick, covered with canvas, has been placed on the walls of the train dispatcher's office of the Middle Division of the Pennsylvania, at Altoona, for the double purpose of excluding outside noises and diminishing the echo of noises within, several loud speakers being used on the telephone dispatching lines. The silencer on the ceiling includes one thickness of asbestos, then a layer of felt and another layer of asbestos, perforated. The dispatchers working at the loud speakers find conditions much pleasanter than formerly. The sounds which formerly echoed through the room now die away.



Mr. Roadmaster Do you know that by mixing CAL with your favorite brand of PORTLAND CEMENT you can

SECURE a denser, stronger, concrete consequently a surface with fewer cracks to invite damage.

That the high workability of drier mix CAL-concrete is a positive safeguard against excess water.

CAL-concrete because it is fatter insures more compact placing in forms and improved contact with reinforcement.

CAL by accelerating the set and strength of concrete permits re-use of costly forms at very substantially lower construction cost.

That strength obtained in recent tests by the American Bureau of Inspection and Test, Chicago, showed as follows:

1500 lbs. concrete in 3 days from a workable 1:2:4 mix—880 lbs. in 24 hours—1200 lbs. in 48 hours and 2200 lbs. in 3 days by using a 1:1½:3 mix.

That cities, towns and street railways have used CAL for years.

That CAL is the proven product of one of the country's largest manufacturers of Portland Cement.

That from a standpoint of higher efficiency, direct and ultimate savings railroads for all concrete construction work should make CAL a part of every shipment of Portland Cement.

That more than 10 years of scientific investigation and 6 years of practical use has established the value and safety of CAL.

THERE is only one CAL on the market and that is Oxychloride of Calcium which cannot be obtained in any other form.

CAL fattens, hardens, densifies, waterproofs and frost proofs all Portland Cement.

CAL is a white powder as easy to use as Portland Cement itself—Its color prevents double treatment or omission—It can be accurately measured by volume and requires no preparation on the job.

NORTH AMERICAN CEMENT CORPORATION
Successor to Security Cement and Lime Company
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For the past 4 years, sales of deLavaud Centrifugal pipe have exceeded production facilities

there are over 1,500,000 lengths of this pipe already in service in this country

With the opening of our new producing unit we now offer this pipe in all sizes from 4 in. to 20 in.

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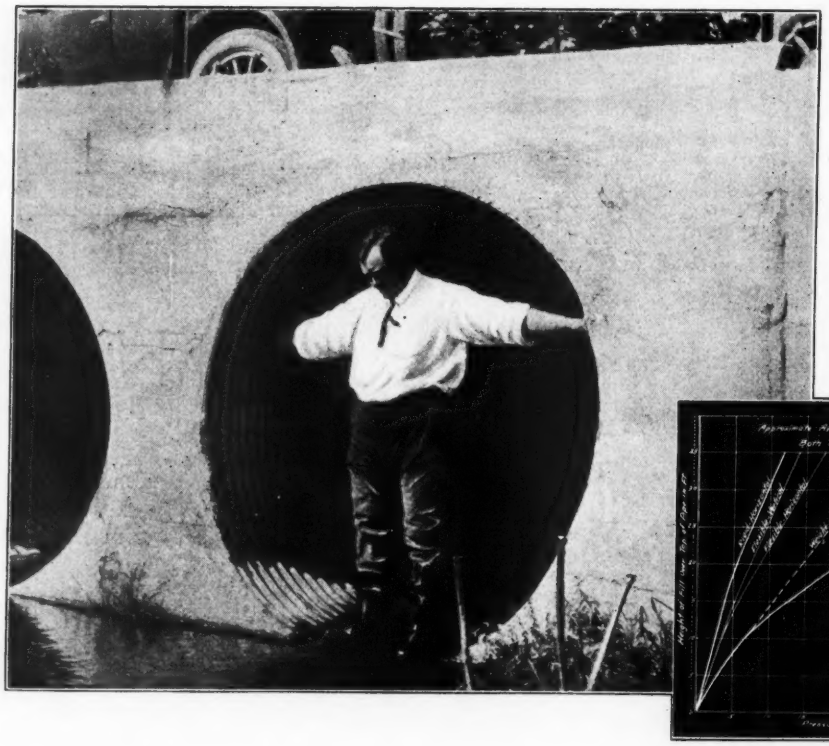
Another ARMCO Achievement!



Note the vertical and horizontal pressure curves for the flexible type culvert show that the pressure is evenly distributed over the top and sides, while with the rigid type the load concentrated on the top of the culvert is even greater than the weight of fill.

Large Diameter Culverts

Safe! Efficient! Economical!

ARMCO Culverts now offer an easy, better way to bridge small streams. In sizes from 60 to 108 inch diameters the same economies are obtained that have made the smaller size ARMCO Culvert the preferred drainage structure, namely—

1. Low cost of handling and placing.
2. Speed and simplicity of installation.
3. Freedom from repairs.
4. Ample strength—no breakage.
5. Great durability—low cost per year of service.

Large diameter Armco culverts provide great drainage capacity at so low a cost that there need be no contraction of the roadway. No foundations or abutments, no bridge floor repairs, no painting, no maintenance expense.

Heavy gauge metal, exclusive with Armco, gives added security in the severest service, when needed. From the A. R. E. A. test at Farina, Illinois, has come authoritative proof of the soundness of Armco design.

The service of Armco engineers for assistance in design and installation — is yours for the asking.

ARMCO CULVERT & FLUME MANUFACTURERS' ASSN.
Middletown, Ohio

ARMCO CULVERTS

Consistent performance—because of consistent uniformity

For motor car setouts, signal locations, and any small retaining walls

MASSEY Reinforced Concrete Cribbing is so simple to install that it can economically be used for many little jobs in addition to the big retaining wall installations.

Almost every division has motor car setouts or signal locations on fills that are continually giving trouble. A few cribbing units will put a stop to these trouble calls. A sliding fill may possibly be erased from the worry map by the proper use of Massey Cribbing.

Two simple members—a header and a stretcher—meet all ordinary conditions. Their permanence and ultimate economy are assured by the high quality concrete which is the natural result of the factory methods followed in all Massey plants. Massey Cribbing can be laid by two laborers without special equipment.

Consult our engineers on any retaining wall problem.

Massey culverts standard construction

Massey Reinforced Concrete Pipe has been standard for nearly two decades. It is now used on a majority of leading roads. Sizes from 12 inches to 84 inches are available for prompt delivery from a nearby plant. Let us quote on your requirements.

MASSEY

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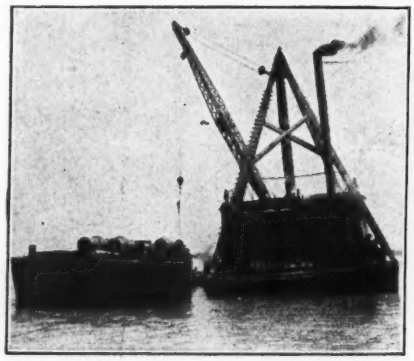
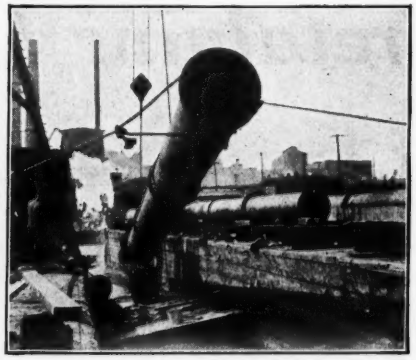
REM10—Gray

For Permanence
CAST IRON PIPE



Showing the pipe laying equipment with which the new line to deep water was laid to supply the 27th Street Shops of the Illinois Central Railroad—Chicago.

44th Annual Convention
The Roadmasters and Maintenance of Way Association of America
Chicago 1926



Flexible joint Cast Iron Pipe was used to allow for wave action and settlement as the lake at this point is to be later filled in as a part of Chicago's park system.

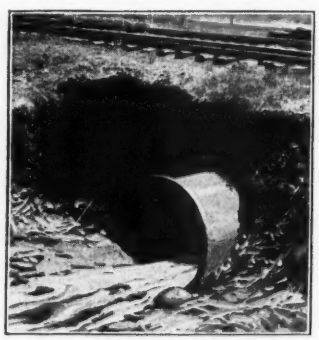
IN the new line to deep water recently completed by the Illinois Central Railroad, Cast Iron Pipe is used as it is used for practically all railway water supply lines in America.

The Waterworks Engineer almost invariably builds for permanence. His work is expected to last for 50, 80 or 100 years.

Naturally, the great durability of Cast Iron Pipe recommends itself to the Waterworks Engineer. With the Bell and Spigot Joint it has become the accepted standard for underground construction.

Water systems in America are not yet old enough to determine the limits of the working life of Bell and Spigot Cast Iron Pipe under average conditions. Mains are still in service today that were laid more than a hundred years ago. Cast Iron Pipe, in usable condition, is constantly being dug up, after being in the ground 50, 80 or 100 years.

Pipe that is fifty years old is regularly relaid with the expectation that it will last at least as long again.



A Cast Iron Culvert—Cast Iron also gives remarkably long service for this use.

With Cast Iron Pipe you never need to guess. Its record of practicability and durability is proven.

This Bureau is organized to assist in any questions of pipe usage and water supply that may arise. We hope that you will feel free to take advantage of our facilities during the coming year.

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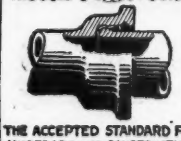
CAST IRON PIPE

Our new booklet, "Planning a Waterworks System," which covers the problem of water for the small town, will be sent on request

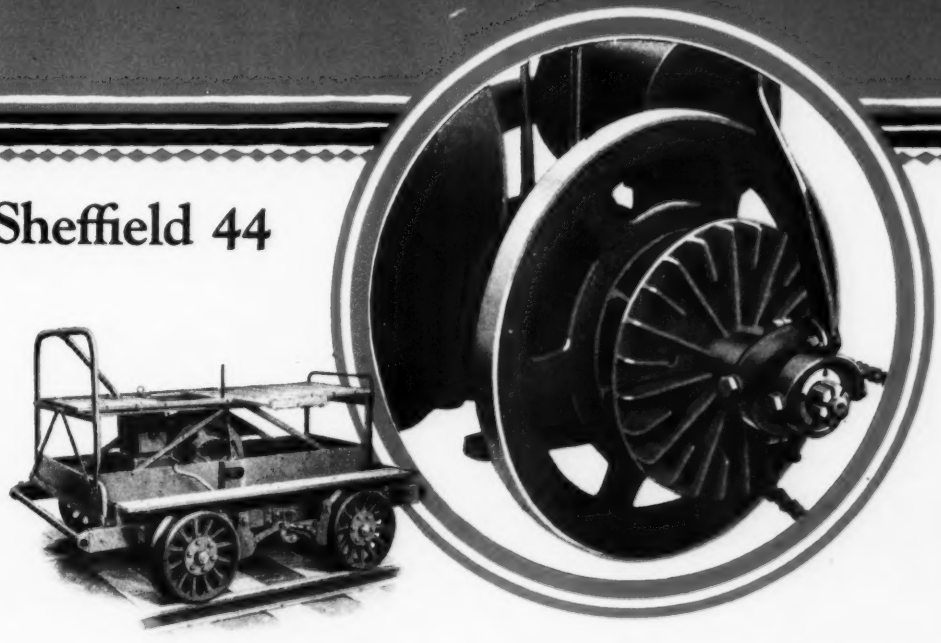
THE BELL & SPIGOT JOINT



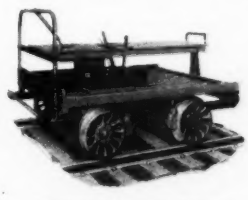
THE ACCEPTED STANDARD FOR UNDERGROUND CONSTRUCTION

Send for booklet, "Cast Iron Pipe for Industrial Service," showing interesting installations to meet special problems

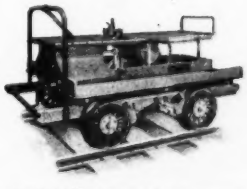
Sheffield 44



The real test is on the rails



Sheffield "45"—the *fine* car of section motor cars



Sheffield "40-B" with 22 square feet of deck space

The real test is on the rails—and that's where Sheffield cars have undergone every conceivable test and proved their ability to meet all demands and conditions of section motor car service.

In the one-cylinder, water-cooled car class, Sheffield "44" stands apart—a sturdy, powerful car incorporating the biggest single advance in section motor car construction—the famous *won't-burn-out* clutch which controls the car through an efficient chain drive. Various speeds are obtained and loads easily started by slipping the clutch. It's practically indestructible; the cooling fins dissipate the heat; the roughest treatment doesn't faze it. Here is a car that asks no favors at any time. No "tugging"—no "pulling" on tension levers. Never any delays due to broken belts.

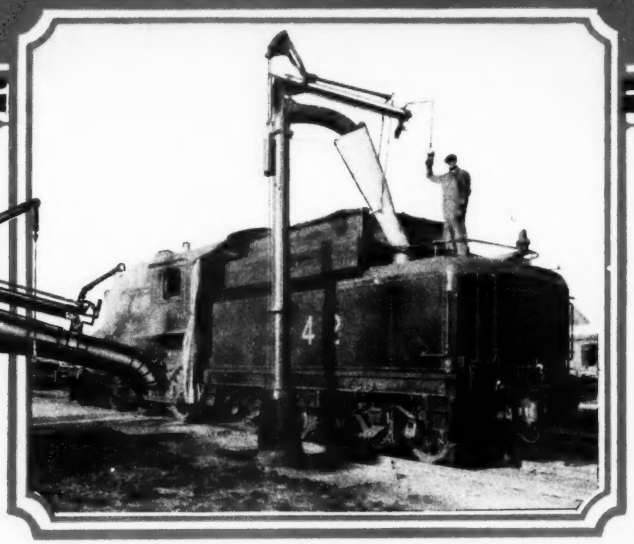
And "44" is only one of the many Fairbanks-Morse cars equally advanced in design and construction.

For meeting the many requirements of section and extra gang service Sheffield "40-B" knows no limitations. Has improved two-cylinder, valve-in-head motor; three point suspension; automobile type pressed steel frame; simple and dependable friction transmission; and other *quality* features.

Sheffield "45" duplicates many of the features of the "40-B" in a lighter, less highly powered car, with the largest deck area ever provided—twenty-two square feet of unobstructed tool space.

FAIRBANKS-MORSE
MOTOR CARS

First on the rails —and still first



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Sheffield Standpipes are designed to meet the demand for improved methods of supplying water to locomotives. Fast valve action, positive operation, large capacity, accessibility of parts and sturdy construction are outstanding features of Sheffield Standpipes.

They also are superior because needle valves and small orifices are not used for the control of the main valve, and the simplicity of the valve system, together with the elimination of the effects of water hammer, insures continuous and reliable operation, even under the most adverse conditions.

A new bulletin, "Sheffield Water and Oil Standpipes," covering the complete line and including valuable engineering data will be sent on request.

Sheffield No. 12 Standpipe

Fast valve action without water hammer
Positive operation
Accessibility of parts
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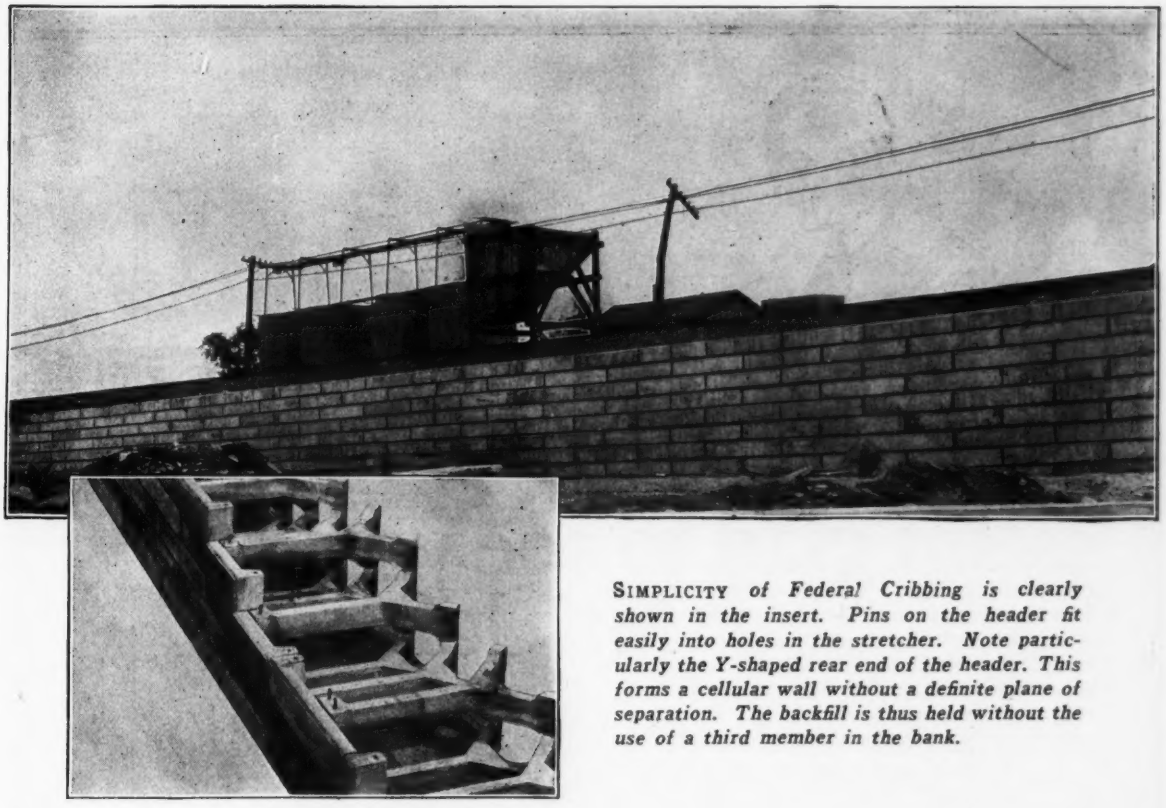

SIMPLICITY *of Federal Cribbing is clearly shown in the insert. Pins on the header fit easily into holes in the stretcher. Note particularly the Y-shaped rear end of the header. This forms a cellular wall without a definite plane of separation. The backfill is thus held without the use of a third member in the bank.*

The backfill can not filter through

FEDERAL Concrete Cribbing assures a retaining wall of strength and durability with the fine appearance of good masonry. It forms a closed-face wall. The only openings are one-inch continuous slots which provide free drainage. The backfill can not filter through, and vegetation can not secure a foothold.

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608 South Dearborn Street, Chicago, Illinois

FEDERAL CONCRETE CRIBBING

THESE power heads are totally enclosed, self-lubricating, with gears operating immersed in a bath of oil, making a very quiet and smooth running power head.

The massive main frame serves as a complete housing and a rigid support for all working parts. The main gear is driven through a pinion which actuates a crank shaft, which in turn actuates an all-steel walking beam which operates the crosshead. This power head may be slid back upon its base, which permits the removal of the rods and drop pipe without tearing down the installation or disturbing pipe connections.

While illustration shows motor drive, these power heads can also be successfully operated with a gasoline engine.

They are made in both 18-in. and 24-in. stroke

These heads are more fully described in bulletins, sent on request.

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No flange cutting—that's one of the strong features of the Reading Replacer. It results in longer life.

Replacer can't tip over—lugs rest on rail base and engage under side of rail head. Correct flangeway prevents wheels running over top of rail.

Every Reading Specialty has similar advantages—that make this line leaders where effective performance on an economical basis is insisted upon. Our new catalog covers list below — send for it.

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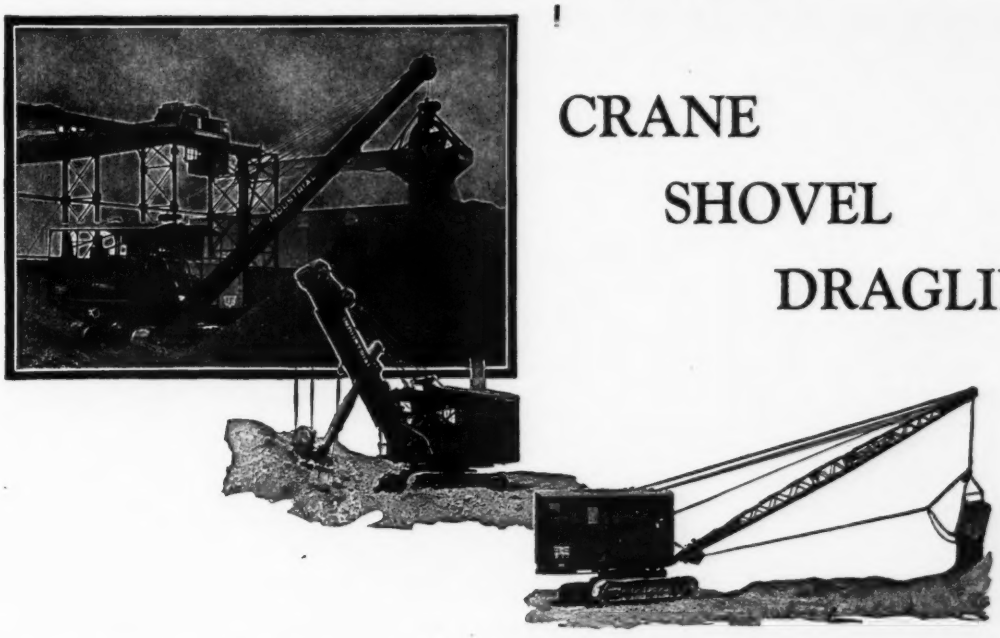

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Unskilled Labor Can Be Made Productive

UNSKILLED labor is apt to be included under the head of non-productive labor and thus classed as overhead expense. It is too often treated as a necessary evil. But this class of labor can be made productive.

Wages of unskilled laborers increase at a much faster rate than the wages of skilled labor. Eighty per cent of unskilled labor in industry is used to move materials. How many unskilled laborers have you on your payroll?

Coal trucking is dirty, demeaning, soul crushing; it depresses the spirit, stoops the shoulders, corrodes the face. Giving men laborious, strength-sapping work which can be done better by mechanical power is both inhuman and unprofitable. There is a better way!

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INDUSTRIAL steam-operated cranes, shovels and draglines may be equipped with the patented PARKER SCALE-PROOF BOILER. This SCALE-PROOF boiler is an exclusive INDUSTRIAL feature. It insures prolonged life, less care and the end of your boiler troubles.

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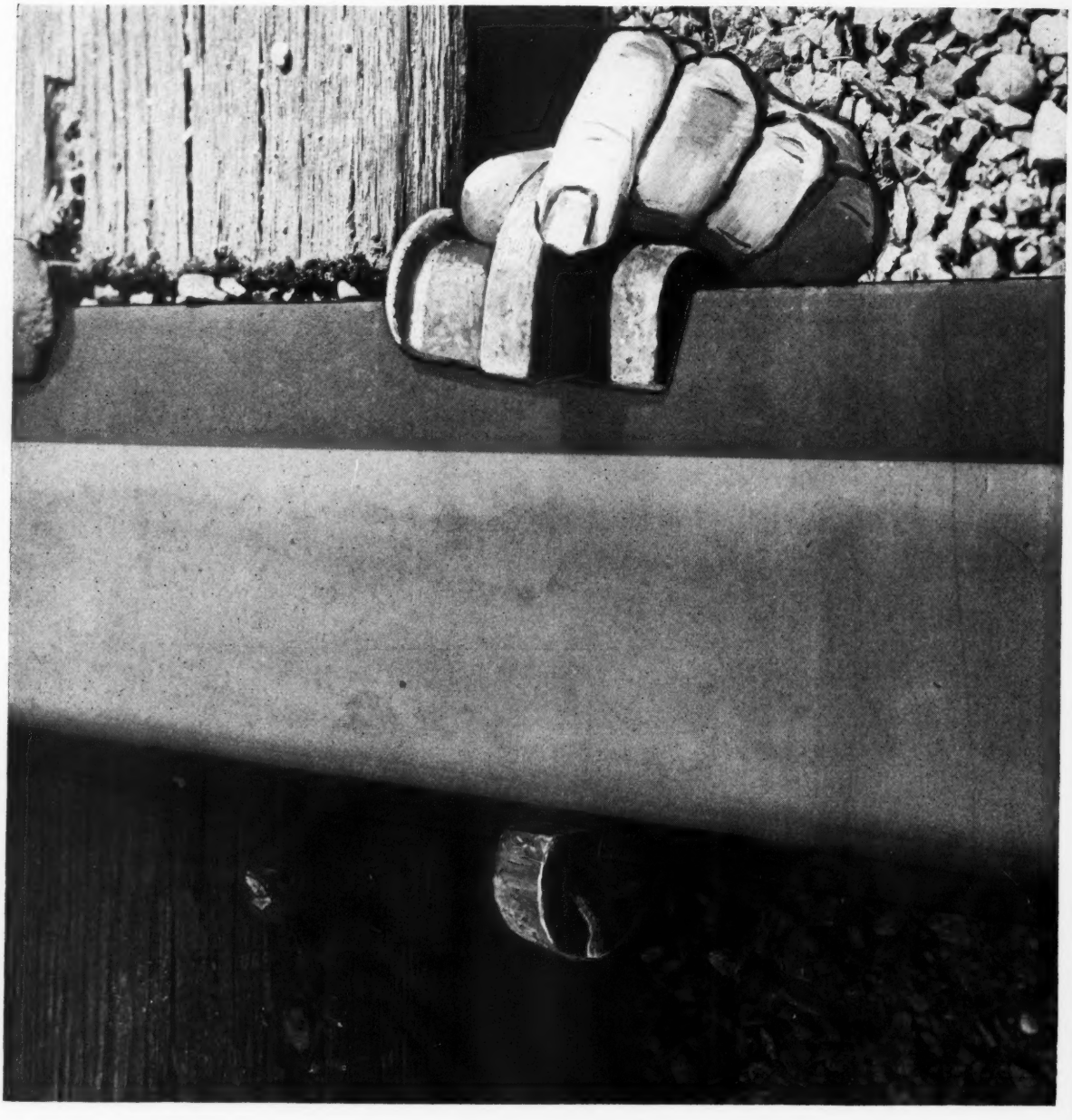

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Many rail anchors operate perfectly in the warm, summer months; but when the winter comes, they fail. The clutching hand of frozen ballast snatches at them, drives out some essential piece of the mechanism, or otherwise loosens their grip upon the rail.

The Ericson Rail Anchor works just as well in winter as in summer. Four years of service on the railroads in Canada proves their unfailing ability to defy frost.

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